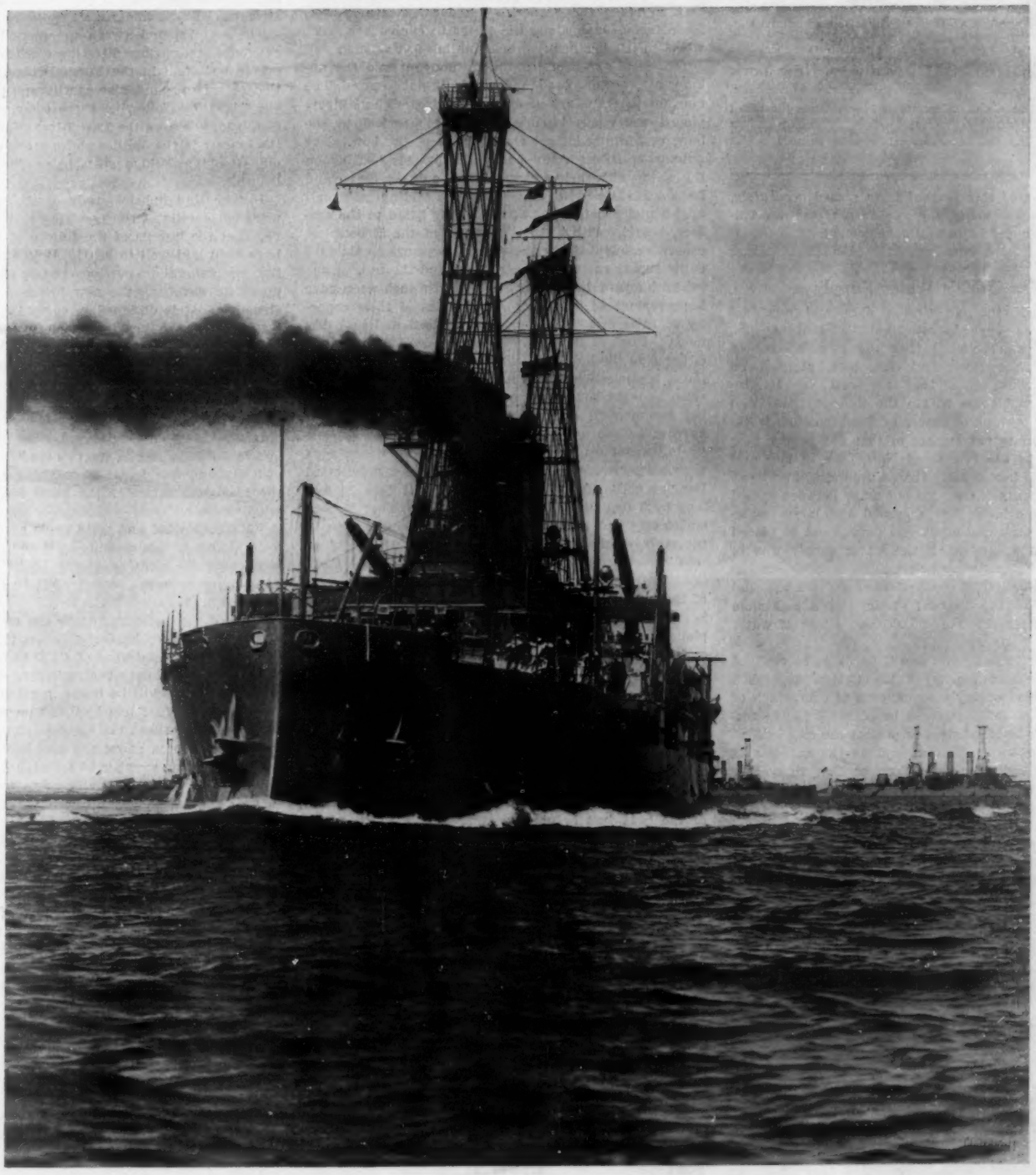
SCIENTIFIC AMERICAN



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THE PRE-DREADNOUGHT BATTLESHIP "LOUISIANA"

Completing the Ashokan Reservoir

Automobile Novelties

Vol. CXI. No. 3
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

New York's Water Supply

WHEN the old Croton dam and aqueduct were opened, over half a century ago, it was believed that the new scheme of water supply for New York had been planned on such a generous scale, that the call for its increase would not come within the time of those who witnessed the opening of that very fine municipal work. Little did the city government of that day realize how rapid would be the growth of New York in size and population, and how quickly it would outstrip every one of its municipal facilities; for not many decades passed before it was evident that a second and larger aqueduct must be built and additional dams must be placed in the Croton watershed, if the water supply was to keep pace with the ever-accelerating growth of the city's population. The completion of these additional works placed at the disposal of the city a maximum supply of not far short of 400,000,000 gallons of water per day.

Some ten or twelve years ago it began to be realized that the maximum supply of the Croton watershed through a period of dry seasons, even if every inch of rainfall were stored that could be gathered in the reservoirs, would be insufficient to protect the city against the peril of a water famine; and as the outcome of an intelligent agitation carried on at that time, New York city to-day can point to the stupendous scheme for an additional water supply, which is now nearing completion in the Catskill region, and throughout the 125 miles of distance covered by the Catskill Aqueduct between Ashokan reservoir and the southerly limits of New York. The inauguration of this work was one of the most commendable achievements of Mayor McClellan's administration.

Not a minute too soon was the construction of these great works undertaken; for at the present time New York is adding to its population at the rate of about 175,000 persons per year—a rate of growth which has never been approached in any city in the world.

The two aqueducts (old and new) bring into New York the waters of the Croton watershed, nearly 400,000,000 gallons per day, when they are both running to their maximum capacity; and when the whole of the Catskill watershed that will be tributary to the Catskill aqueduct has been developed, it will be possible to bring in an additional 500,000,000 gallons of water per day. How long this combined supply of nearly 900,000,000 gallons of water per day will suffice to meet the needs of the growing city, not even the most skilled student of the problem of this city's water supply can foretell. If the rate of the growth of the city should continue to increase as rapidly in the future as it has in the more immediate past, it will not be many decades before the serious study of the question of yet an additional water supply will have to be undertaken.

Perfecting the "America's" Water Wings

THERE has been some inquiry as to what Mr. Curtiss has been doing with the Rodman Wanamaker transatlantic flier since her formal launching and first successful flight, on June 23rd, previously described in the SCIENTIFIC AMERICAN. The answer is very simple; he has been trying the best methods of making her lift from the water as much weight as she can carry in the air. She has very efficient air wings. He is trying to provide equally efficient water wings, or members for lifting the bottom of the hull to a level with the water surface, making it skim the surface very swiftly, then clear the water entirely and soar through the air with minimum resistance.

The original "America" rose well only with a moderate load, and decidedly "wallowed" with her full weight of 5,000 pounds; that is, she plowed deeply and could not rise enough to skim. In fact, her bottom was too narrow for shallow draft, too narrow for very effective planing or skimming under full load. The bottom of the bow averaged about four feet in width, had to displace, together with the wing tip floats, 80 cubic feet of fresh water, and actually sank about a foot and a half when at rest. The problem was to find the best way to make the "America," under her own power, move fast enough along the water to enable her great wings to lift her bodily when totaling 5,000 pounds.

Two rival types of lifters, the buoyant and the unbuoyant, were proposed, and hurriedly put to proof. The buoyant lifters might be common hydroaeroplane floats placed under the biplane wings, or attached to the bow, or forming lateral excrescences of the bow. The unbuoyant lifters could be planing boards bearing on the water with their under surfaces only, or they could be solid little wing-shaped blades gliding at small angles underneath the water till they lifted to the surface, bearing with them the weight of the airboat not otherwise sustained by the upward pressure on the hull or its superstructure, the air wings and the tail.

The buoyant lifters were tried with such successive improvement as to satisfy Mr. Curtiss of their capacity to raise eventually the required load and probably more. First hollow protuberances were built along either side the bow, following its lower edge, and having a cross-section like a horizontal V. These exerted some buoyant lift and some dynamic lift under speed, but not enough of either. They were probably too narrow. Then ordinary flat Curtiss hydroaeroplane floats, turned up at the prow, were placed under each wing. They were, in fact, taken from the rehabilitated Langley aeroplane, nearby, and measured each 10 feet long by 3 feet broad and 6 inches thick. They buoyed sufficiently and planed well. The entire craft rose in the air several times with approximately the required total weight. Mr. Curtiss then thought to apply these floats at either side the bow, or to build out the sides of the bow to form such buoyant gliding surfaces. But he wished first to test the possibilities of hydroaeroplane blades, exerting only dynamic lift in the water, and offering much less head resistance in the air.

Accordingly he fixed to either side of the boat, flush with its under surface, firm wooden wings, each 6 feet long by 18 inches broad, flat below, cambered above, placed at a slight dihedral angle, and about under the center of lift of the air wings, to which they were trussed with stream-line posts and stay wires. Their angle of incidence was about the same as that of the air wings, and precisely the same as that of the bottom of the boat just before the step. These water wings were totally submerged at the start, but quickly lifted the craft till their tips rose out of the water. Then the lift fell off before the hull began to plane. Fourteen inches below these were then placed parallel wings extending from the keel outward 4½ feet to either side, and trussed to the boat's bottom and the first set of wings. They were flat below, cambered above and 10 inches wide. With this combination the whole boat, with five men and 500 pounds of supplies, was heaved bodily out of the water, about 6 inches, at a speed of less than 20 miles an hour. Naturally the air wings could not keep her out at this velocity, since her natural flying speed is 60 miles an hour. In the later experiments, which were halted on July 8th, a water winglet about 18 inches long by 10 inches wide was fixed to the stern of the boat, while the main water blades of biplane form were placed shortly before the center of gravity, the combination thus giving a three-point support for purposes of automatic stability. When the last two runs were over, everyone was satisfied that this type of flying boat can be perfected to rise and glide on its blades at a true flying speed, and then take to the air on level wing. But it was thought best to postpone further experimentation of this sort, and to apply pontoons at once to the sides of the bow, in order to have the boat ready for shipment from Hammondsport by July 18th.

The hydro blades used by Mr. Curtiss, both those at the bow and the one at the stern, were fixed. Their angle of incidence could be changed equally by use of the air elevator, canting the whole boat fore and aft. Obviously all these blades can be pivoted and independently or conjunctively controlled as to their angles of incidence, as is done with the elevator and wings above them. Thus the craft can be made to glide on even keel at any speed, its unbuoyant dynamic water wings and elevator functioning in the familiar manner of those of an aeroplane, until a flying speed is attained and the craft leaves the water.

A Brobdingnagian Structure

NOW that the massive piers have been completed and the work of erection of the steel superstructure is under way, public interest will be quickened in the second attempt to span the broad St. Lawrence River with a cantilever bridge, which, in strength, weight, capacity, and length of span, will be the greatest structure of the kind in existence. That this second attempt will be successful there can be no doubt whatever. The failure of the first Quebec bridge, as was pointed out by this journal at the time of the disaster, was due to faults in design which were so glaringly evident, even to the lay mind, that it is a marvel that they should have found their way into a structure of that importance.

The main span between the piers is the longest in existence, measuring 1,800 feet. The second longest are to be found in the Forth Bridge, Scotland, where there are two spans, also cantilevers, each 1,710 feet in clear length. Following these come the great suspension bridges across the East River, New York, of which the longest is the Williamsburg span, of 1,600 feet, the old Brooklyn Bridge span being just 5 feet less in length.

It takes but a brief study of the main outline and principal details of the new Quebec bridge to be satisfied that the lessons of the failure of the old structure have been laid well to heart. Both in its skeleton outline and general proportions and in the detailed make-up of its members, the new bridge is a vastly better structure. It is designed to carry two railroad tracks loaded with the heaviest modern freight traffic and two footways. The live load for which the bridge is designed is 5,000 pounds per linear foot on both tracks for their full length with two of what are known as E-60 engines, both the train loads and the engines being so arranged on the bridge as to produce the maximum possible stresses. A wind load of 30 pounds on every square foot of the two trusses and a wind load of 300 pounds per linear foot on the exposed surface of the train was taken as the basis for determining the wind stresses.

With such wind and train loads assumed on a cantilever bridge of this magnitude, it can readily be understood that the sections of the various members have run up to enormous sizes. Thus to take care of the stresses in the upper chords of the cantilever, the section of the member next to the main post required no less than 32 eyebars, 2⅞ inches thick by 16 inches deep, having a total area of 1,120 square inches.

The greatest interest attaches to the lower chord members, for it will be borne in mind that it was the failure of the first panel of the lower chord, next to the pier, that caused the collapse of the earlier bridge. This member was about five feet square. In the new bridge the same member is 7 feet 2 inches deep by 10 feet 4 inches wide, it has a cross-section of 1,902 square inches, and its weight between panel points is about 400 tons. The member consists of four webs 7 feet in depth, each web consisting of four plates riveted together and having an aggregate thickness of 3¾ inches.

It will be remembered that the bottom chord of the old bridge failed because of the absurdly light character of the latticing which was used to hold the webs in true axial line. This latticing, if we remember rightly, consisted of angles measuring only 3½ by 4 inches on the side. In the new bridge the webs of the corresponding member are tied together with 8½ by 8½ by 1 inch thick lattice bars at top and bottom, and by horizontal steel diaphragms, running through the whole length of the member at the mid-height of the webs. They are further held in place by transverse plate diaphragms disposed throughout the whole length of the member.

Even more impressive in size and weight is the main post of the cantilever over the pier. Built up of four separate columns latticed together, it measures on the outside 9 feet by 10 feet. Its maximum cross-section is 1,903 square inches, and each post weighs no less than 1,500 tons. The shoe at the foot of each post is 19 feet high, 22 feet by 26 feet on the base, and weighs over 400 tons.

Throughout the whole bridge, whatever part of it may be considered, we find the same massive proportions. Thus, in the connections at the shoe on the main piers, above referred to, the main members, such as the bottom chord and the main post, bear upon pins, each of which is 30 inches in diameter and weighs over 6 tons. Again, the floor-beams, because of the great span between panel points, run to unprecedented dimensions. Generally, they are 10 feet in depth and each weighs about fifty-five tons. They are connected to the posts by 11-inch pins, which pass through the web of the floor beams (reinforced for this purpose) and through the posts.

Electricity

Telephone Bridge Across the Sea.—Press dispatches state that while giving evidence before the Dominion's Royal Commission recently, Godfrey Isaacs, of the American Marconi Company, declared that Mr. Marconi expects to establish wireless telephone communication between Carnarvon, Wales, and New York, as soon as certain mechanical details have been carried out at the former station, and he hopes that this will be done before the end of the year. So far, Mr. Marconi has made public no tests or experiments that would justify such a prediction.

Electric Railroad in the Tyrol.—The electric railroad known as Mebertscher Bahn is a short line of recent construction in South Tyrol, and it serves to connect the southern railroad station of Bozen, by way of Kaltern and St. Anthony, with the Mendelpass mountain incline, which starts at this latter place. Of 10 miles length with standard gage track, the line is operated entirely by adhesion, even though the maximum gradient is 6.2 per 100. A sub-station at Eppan, supplied by a power line, serves to furnish 1,200-volt continuous current for the electric road. Passenger and freight trains are drawn by motor cars carrying two electric motors of 100 horsepower each.

Recent Wireless Telephone Experiments in France have attained results that may have a far-reaching importance. With a transmitting station set up at Paris, long conversations are sent out and picked up at points over a hundred miles off. As explained in a recent note, the electric arc system of the officers Colin and Jeanci is used, working a 150-foot antenna. Ordinary wireless apparatus, such as even amateurs possess, will receive the spoken message. For instance, a small wireless station at Mettray, 120 miles from Paris, could receive long newspaper articles which were being read into the sending apparatus. More striking still was the use of a wireless telegraph motor car of usual make-up, with a 100-foot portable antenna mast which could be erected on the ground in 20 minutes. Conversation could be heard from Paris at a distance of 60 miles by a reporter of the *Matin*, from which journal we take our present account. Capt. Colin speaks of the great military use of the method. For instance, the general can send out orders direct by telephone to the field or to battleships. Tuning can be varied, so as to prevent interference.

A **"House Electrical"** will occupy a conspicuous place in the Manufacturers' Buildings at the Panama Pacific International Exposition. It will be the first model electrical home to be specially designed and built for the purpose by a skilled architect. It will be a full-sized house, of the attractive California-Spanish type, with electrical garage, workshop, creamery, etc., located nearby. Each room will be equipped with practical labor saving and comfort promoting devices operated by electricity. The kitchen, where most of the housework is accomplished, will be provided with an electric range for all cooking purposes, and with electrically driven machines for peeling vegetables, polishing silver, freezing ice-cream, driving cake and dough mixers, and doing other necessary work. In the electric laundry, the clothes will be washed by electric power, and ironed with electric flatirons. In striking contrast, the adjoining room will have an electric refrigerating plant of household size. The dining room will be arranged to show how light luncheS and suppers can be cooked with the electric chafing dish, or the electric grill, on the table if desired. The garage will contain an electric runabout, battery charging outfit, etc. Adjoining the garage is to be located a small work-shop, completely equipped with electrically driven tools.

The Use of Electric Motors for operating water-supply plants by the use of piston pumps is on the increase, and in Germany there are already quite a number of examples of this practice. Among others, we may mention the Duisburg water works, which employ two Allgemeine 3-phase electric motors of 300 and 170 horse-power, arranged so as to be belted to the Borsig piston pump. Speeds are 242 and 144 revolutions per minute for the motors. Electric drive, by the use of these motors, is especially good for small town water works, and it is now found economical, besides having other advantages. At Strausberg, there is a small plant which uses a 21 horse-power continuous-current electric motor coupled by belt to a piston pump, and a larger plant lies at Erkner, using in this case a 100 horse-power Allgemeine electric motor of the 3-phase type running at 485 revolutions per minute. But for larger sized plants, the best practice is to use a slow-speed electric motor so as to be able to couple it direct on the pump shaft, and this method is adopted by the new plant of Spieser-Muhlenthal. Each piston pump has a 150 horse-power 3-phase electric motor direct-coupled to its shaft, working at 5,000 volts. The new Wuhlheide works, which the city of Berlin is now operating by 3-phase current at 6,000 volts, are laid out on the same ideas. Here a single large electric motor has a pump on each end of the shaft, the motor thus lying between the two pumps. It is rated at 400 horse-power. Such a group is very compact. The speed is 73 revolutions per minute in this case.

Science

The "Carnegie," the non-magnetic yacht of the Carnegie Institution, left Brooklyn June 8th on another magnetic surveying cruise. This one is to last only six months, and is to be in northern waters, with calls at Hammerfest, Norway, and Reykjavik, Iceland.

A Dental Research Laboratory has been established at the Royal Dental Hospital in London, chiefly with the aid of a gift of £1,000 from Mrs. John Hampton Hale, whose late husband was chairman of the managing committee of the hospital.

Luminescence of Nitrogen.—It has been found that nitrogen, vigorously and spectroscopically pure, acquires a continuous luminescence, during the electric discharge, and therefore this phenomenon can no longer be attributed to the presence of traces of oxygen. In the presence of metallic vapors, such as those of mercury, sodium or potassium, the phenomenon is not produced owing to the nitrogen's being attacked by the metallic vapors, forming a combination of the metal with nitrogen. The presence of oxygen, which oxides the metallic vapors, hinders their action on the active nitrogen and renders its formation possible.

Fishes that Live at Great Depths.—The Prince of Monaco reports concerning his cruise made between July 22nd and October 10th, 1913, between the European and North American coasts. Some most interesting studies were made of a series of specimens which inhabit a depth of over 3,000 feet in the ocean, and which come as near the surface as 300 feet, during the night only. This fact is a most noteworthy one as regards physiology, for such specimens have a surprising facility of supporting the enormous decompression which is due to this change of depth from a point of high pressure to one of low pressure, this being done at such frequent intervals, also the recompression when again descending.

Antarctic Journalism.—A London publisher is preparing to issue a lithographic reproduction, in facsimile, of the typewritten illustrated magazine with the production of which the members of the British Antarctic Expedition of 1910–1913 whiled away the southern winter of 1911. It is known as "The South Polar Times, Vol. III," its predecessors, volumes one and two, having been the work of Capt. Scott's earlier expedition, and having also been reproduced in facsimile. The editor of the latest volume was Apsley Cherry-Garrard. The leader and most of the staff contributed articles; while colored illustrations, silhouettes, caricatures and photographs were supplied by Dr. Wilson, Commander Evans, B. C. Day, D. G. Lillie, and H. G. Ponting.

Classified Lists of Government Publications.—The practice inaugurated a few years ago by the Superintendent of Documents, at Washington, of issuing separate classified price lists of the publications offered for sale by his office has been continued and developed, until upward of fifty of these useful bibliographies are now available. Most of them have been issued in numerous editions, and thus kept up-to-date. Selecting a few of these lists at random, we find that they deal with such varied subjects as "Food and Diet," "Fishes," "Indians," "Geography and Explorations," "Plant Life," "Mines and Mining," "Alaska," etc. Each pamphlet contains the titles of hundreds of government publications, grouped under appropriate sub-headings, which are arranged alphabetically.

An Instrument for Measuring Turbidity in liquids, gases, and solid plates—i. e., a "turbidimeter"—has been devised by P. V. Wells, of the U. S. Bureau of Standards. A collimated beam from an intense source of light passes through a variable thickness of the turbid medium, and is totally reflected by a prism, thence forming a uniform beam in one field of a photometer. The diffracted light is not totally reflected, but is refracted by the prism into the other aperture of the photometer. Thus the reading of the instrument is a function of the ratio of the intensities of the light scattered and transmitted, which, in turn, varies with the turbidity. A form of this instrument is to be used in the measurement of fog density, in connection with the International Ice Patrol. It seems likely to prove more useful than any of the other existing forms of fog-gage.

An Oceanographical Institute in Edinburgh.—At a meeting held May 25th in the rooms of the Royal Society of Edinburgh, plans were made for a National Oceanographical Institute to be established in Edinburgh as a memorial to the late Sir John Murray. Edinburgh is already the principal center of oceanographic research in Great Britain, as it is the site of two important laboratories of oceanography; one established by Murray in 1876, on his return from the "Challenger" expedition, and the other founded twenty-one years later by Dr. W. S. Bruce. The "Challenger" office contains the finest collection of deep-sea deposits in the world, while Dr. Bruce's laboratory is especially rich in polar marine fauna, notably in abyssmal forms. It is proposed to combine these collections and affiliate them with the University of Edinburgh, and also to establish a lectureship in oceanography in the university.

Aeronautics

Shutters in Planes.—In a patent, No. 1,099,146, George C. Beidler, of Rochester, N. Y., shows an aeroplane whose planes are provided with automatically controlled shutters for aiding in stabilizing the machine.

Another Safety Device for Airships.—Thomas A. T. Yerness, of Chicago, Ill., in a patent, No. 1,100,277, provides means to be applied to an airship to prevent it from falling too rapidly in case of accident, or if the operator should lose control of the machine.

Orville Wright's Proposed Retirement.—It is announced in the daily press that Orville Wright has expressed a desire to withdraw from the active business management of the Wright Company and to confine his attention to actual inventing and engineering. The Wright Company will probably be reorganized.

Disappearing Running Gear for Aeroplanes.—Frank McCarroll, of Dallas, Tex., has secured a patent, No. 1,097,816, providing a running gear for aeroplanes which can be disposed out of sight and out of the plane of movement of aeroplanes after the machines have risen from the ground. Thus he reduces air resistance in flight.

A Governor for Aeroplanes.—Ray E. Kellog, of Los Angeles, Cal., in a patent, No. 1,097,645, provides for controlling and regulating the pitch or angle of propeller blades in accordance with the speed of flight, so that the air pressure upon the propeller blades will be equalized in proportion to the centrifugal force.

A **First-aid Package** is hereafter to be included in the equipment of every aeroplane belonging to the German army. It will be placed behind the seat of the pilot, and marked with a conspicuous red cross, so as to be readily found by the first person to reach the scene of an accident.

A Pendulum Aeroplane Control.—In patent No. 1,098,098, James V. Crowthers, of Philadelphia, seeks automatically to control the movement of the warping plane, aileron or other movable part, by a suspended gravity controlled weight which co-operates with such parts in forming an equilibrator.

A Stabilizer Which Eliminates the Drag.—Martin L. Kors, of Chicago, Ill., in a patent No. 1,098,735, provides a stabilizer and other controlling means for aeroplanes, the purpose of which is to supply a stabilizing device which eliminates the drag occasioned by the warping and the augmentation of stress in time of danger from tipping.

Aeroplane Pendulum Balance.—Henry Morse, of New York city, in a patent, No. 1,099,508, provides in connection with an aeroplane an automatically acting balance means, applicable to any type of aerial vehicle, and under control of the operator so it may be brought into operative position and moved out of such position at will.

Propellers that Direct Air Under the Wings.—In a patent, No. 1,098,024, Adalbert Domaradzki, of Cleveland, O., presents a flying machine having wings and propellers which direct air under the wings to aid in buoyancy and flight. The idea is not in accord with the best teaching on the subject, for obviously the planes are constrained to travel in disturbed air.

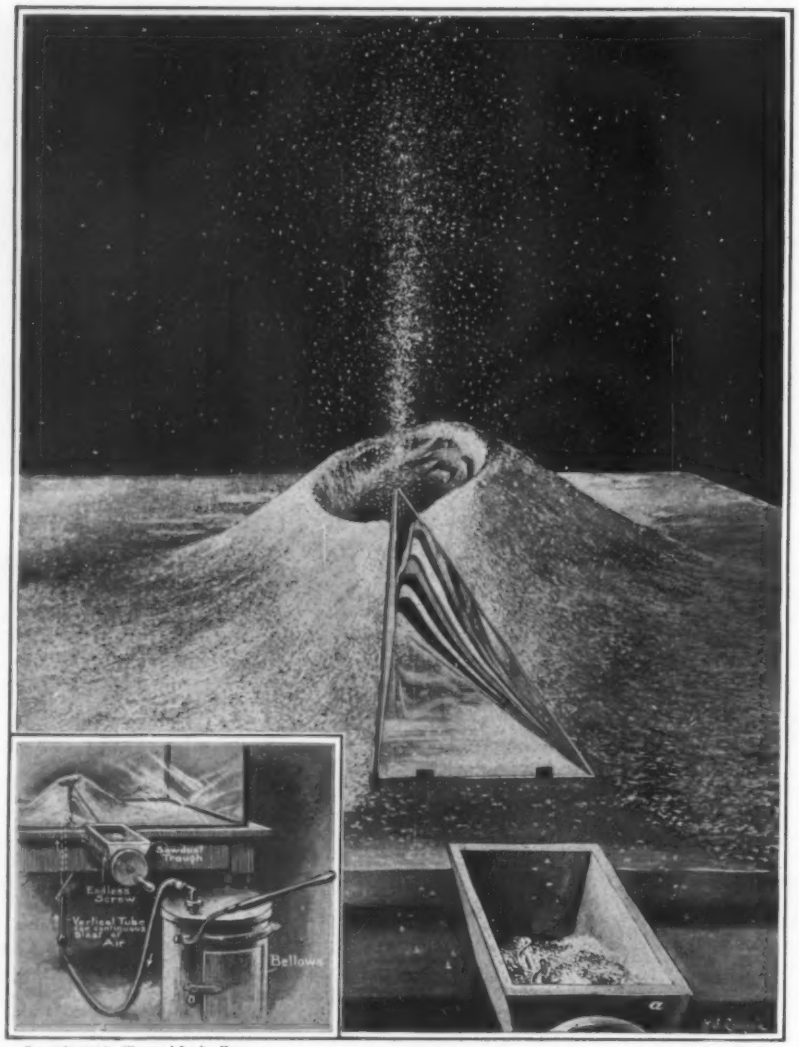
The Navy Aviation School.—A course of instruction for air pilots and one for mechanicians has been approved by Secretary Daniels, and a class of officers and enlisted men will be detailed to take the courses preparatory to the "air service of the sea." A post-graduate course will be provided for promising students, who may be sent abroad or to technical schools in this country.

A Knock-Down Aeroplane.—Patent No. 1,099,762 to Henri Hubert Pagny, Rheims, France, assignor to Société Anonyme des Appareils d'Aviation Hanriot, Rheims, France, is for an aeroplane in which it is claimed the taking down and refitting of the apparatus may be effected rapidly even by unskilled labor, since there is no need to adjust or regulate any part, and the majority of parts subject to deterioration can be changed in a very short time and with ease.

An Official Test of French Aeronautic Motors.—The French War Department has decided to hold an important concourse of aircraft motors, and this event will probably take place early next year. The main lines of the regulations are already drawn up, and the tests will be made upon three classes of motors, namely, small, medium and high power. All constructors will be admitted to the event, including specialists in rotative motor building and the constructors of fixed motors in star or upright designs. It is expected that the concourse will bring out a number of new types of motors; the rules of the contest being of a nature to promote such new forms. The Automobile Club will co-operate in organizing the event and in carrying out the tests, and these will have a different character from the usual testing-bench trials, for it is intended to mount the motors on automobiles with aerial helices, or upon hydro-aeroplanes or water gliders. Tests will be held on various lakes, and the motors will make a continuous run from 5 to 12 o'clock, making variations at the carbureter and other points.

The Mechanism of a Volcano

MR. C. J. WOODWARD has designed a piece of apparatus to illustrate the formation of volcanic cones when the ejected materials are of a fragmentary character, i. e., the "cinder cones," characteristic of expulsive eruptions. This consists of a large square table which is perforated in the center and below which is fixed a vertical tube, connected at the farther end with an elastic tube, leading to a pair of bellows. The latter is worked by a handle, and sends a continuous vertical blast of air up from the table. Into the side of the tube near its point of emergence in the table is fixed another horizontal tube, filled with sawdust which is supplied from an open box at the side of the table from which the tube leads and is continuously pushed forward by means of an endless screw, which is turned by a handle at the end. In this way a vertical shower of sawdust is ejected from the pipe, after the manner in which fragmentary material is ejected from the vent of a volcano. The manner in which the material collects round the vent is thus demonstrated, and by continuing the process with variously colored sawdusts, a cone with central crater, showing the peculiarities of a volcanic cinder cone, is gradually built up. The internal structure of such a cone is here demonstrated by fixing two vertical sheets of glass in a radial direction before commencing operations, and at the end removing all the sawdust which lies between them. In this way the inward slope of the deposit within the crater and the outward slope in the flanks of the cone are fully demonstrated. The proportionate height of the cone depends on the angle of repose of volcanic fragments in one case, and of sawdust in the other, but these are not very different, hence the natural slope of such cones is fairly well shown.



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Model of a volcano, drawn by the "Illustrated London News," from a design prepared by C. J. Woodward. The model is based upon the explanation of volcanic action to be found in Judd's "Volcanoes."

In the accompanying picture, which we are able to reproduce by courtesy of the *Illustrated London News*, the summit of the cone is unsymmetrical; this may be imagined to be due to a draft of air at the time of the experiment, and illustrates the effect which a wind may have in modifying the shape of a real volcano in process of formation. The slope of the cone also shows a characteristic curve, which has been the subject of several investigations by Milne and others. The curvature is approximately logarithmic, and is due to several causes. One is impressed by the general resemblance of the volcano's outline to the "probability curve," which might be expected to result from the greater chance of cinders falling near the crater than at a distance from it. A more important factor, however, in determining the actual shape of a cinder cone is probably the size and weight of the ejecta; the larger particles tend to roll farther down the slope than the smaller, because their descent is less retarded by friction in proportion to their weight. Again, the tendency of a self-supporting heap under the influence of its own weight is to spread out at the base; this also tends to give a logarithmic curve to the slope. Milne has suggested that the Japanese modeled the curved roofs of their houses after the volcanic cones which are so familiar in Japanese landscapes.

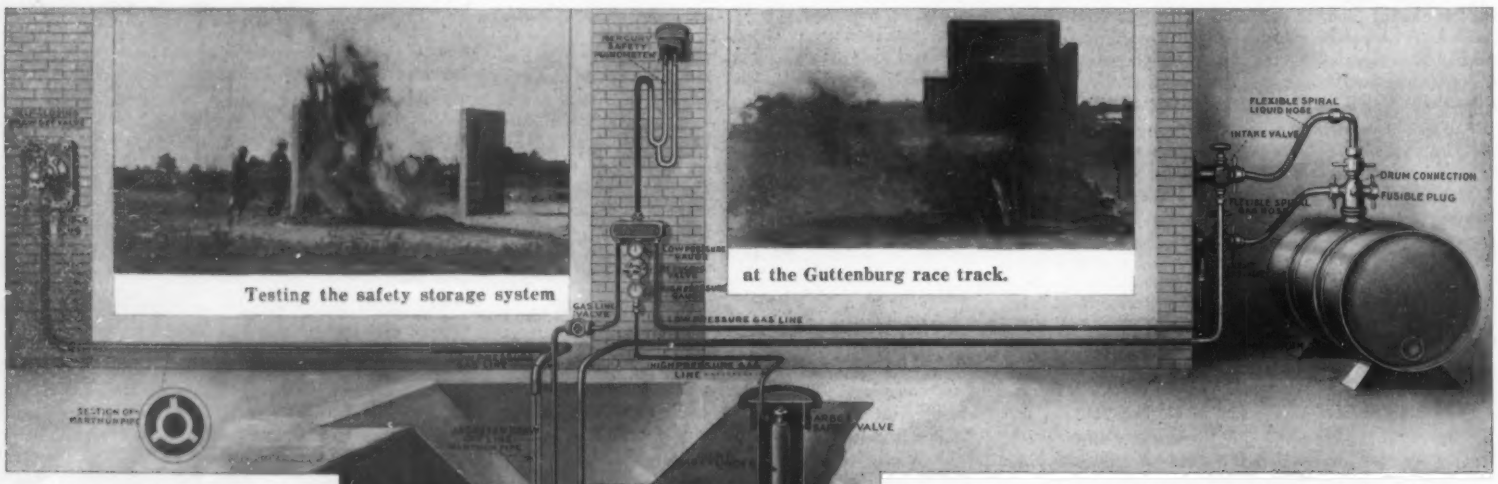
A small electric lamp with a red bulb might, perhaps, be installed in the orifice of the vertical tube. Then if the experiment were performed in a darkened room we should have a realistic reproduction of the apparent flames of a volcano in action, which are in reality merely the reflection of the glowing lava in the crater upon the ascending column of steam and dust.

Testing a Safety System for Storing and Distributing Inflammable Liquids

By Herbert T. Wade

THE storage of gasoline and other inflammable liquids used for internal combustion motors and various industrial purposes, presents many serious hazards, especially in congested cities where the extensive use of motor vehicles requires the storage of a large supply of fuel at garages and distributing stations. Such conditions naturally are a source of danger and worry to fire departments and insurance officials. Despite stringent regulations, which may or may not be observed, even with the best of appliances the danger is as real as it is apparent, and, accordingly, much interest attaches to any method that will tend to minimize the risk not only to the premises in which the inflammable substance is stored, but to surrounding property.

Such a method has been developed in Germany, and after some eight years of thorough test and wide application, it has found extensive use, especially at central stations and garages, where a large number of motor buses or other motor-propelled vehicles are housed, and in the dry cleaning and similar establishments where large quantities of naphtha or other inflammable liquids are used for industrial purposes as well as in the battleships of the German navy for the protection of inflammable liquids. This system, developed in Europe by Martini & Hüneke, is now beginning to find application in the United States. A public demonstration was given on June 30th, which was witnessed by fire and insurance officials as well as by engineers, and others interested, including officers of the United States Army and Navy, at which the success and usefulness of the new method were shown. The success of the protection of gasoline in storage, and as used about a garage, was most apparent, and the spectators were able to witness such striking evidence as an ordinary transportation drum subjected to a fierce fire while delivering gasoline to



Testing the safety storage system at the Guttenburg race track.

An inert gas (carbon dioxide or nitrogen) is used to prevent formation of an explosive mixture.

the storage tank of the system. Some 250 gallons of gasoline in the storage tank itself were exposed to electric sparks of a voltage of 10,000 to 15,000 volts, which under ordinary circumstances would have served instantly to ignite the vapor and explode the contents. Supplementing these tests, and furnishing a most striking spectacle, was the ignition of the gasoline from the storage tank issuing from the draw-off valve discharging to its full capacity without danger to the storage tank and its contents.

(Concluded on page 49.)

The Paul Schmitt Biplane

By John Jay Ide

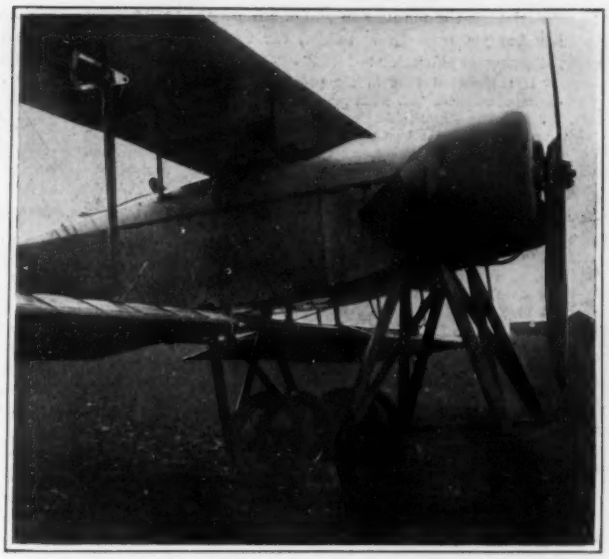
THE alteration of incidence with its complement power variation has long been considered the ideal method of attacking the problem of varying speed in flight. The variation of incidence has also other advantages. It allows the aeroplane to take a horizontal, upward or downward course while keeping the fuselage absolutely level; the maximum efficiency can always be preserved whatever be the variations in useful load and motor power; the machine can rise after a very short run with the tail high, a most valuable feature for hydroaeroplanes; and finally the wings can be made to exercise a very considerable braking power.

For four years Paul Schmitt has been trying to devise a satisfactory means of varying incidence. That he has finally succeeded in evolving a good system is proved by the recent sensational performances of the machine bearing his name. He won the second prize in the recent safety contest for aeroplanes held in France.

The fuselage is made up entirely of steel tubes autogenously welded. This system of construction has many opponents, but if well carried out, as in this case, should give entire satisfaction. The section is quadrangular from the bow to the rear of the seats. Thence the two lower body spars converge until, at a point about two thirds of the entire distance from front to rear, the body becomes triangular in section. At the extreme stern the lower spars divide again and rise slightly, joining the upper spars, which are parallel throughout. This facilitates attaching the elevator. The lower spars also rise slightly toward the bow, thus reducing head resistance. The motor, a 160 horsepower Gnôme carried between two bearers, is covered by a shield on Morane-Saulnier lines and drives a Chauvière tractor. Behind the tanks are the cockpits for passengers and pilot. The top of the fuselage is stream-lined, and the whole is covered with fabric.

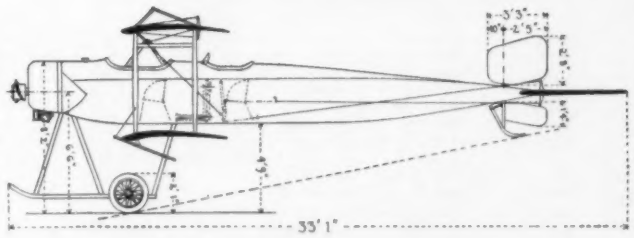
We now come to the most interesting part of the whole machine: the means for varying the incidence. The two planes rotate about a transverse horizontal axis placed rather high up between the planes, and about one quarter of the distance from leading to trailing edge. This axis is a tube swung by ball-bearings on a pair of inverted V stanchions braced at their lower ends to upper fuselage longitudinals. The extremities of the axis are rigidly attached to two deep section oval tubes placed fore and aft between the front and rear upright of the central cellule. The four uprights pass through the fuselage and are joined together at the bottom by steel tubes. They are connected in similar fashion at the top, but in this case the tubes are concealed by the wing section.

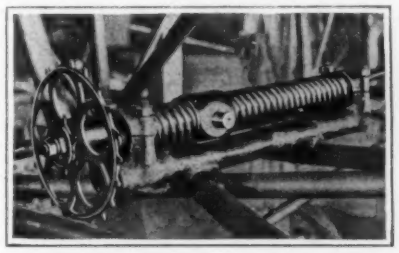
From the above description it will be seen that the central cellule could rotate freely around the axis until the interplane struts finally came in contact with members of the fuselage. In order to control pivoting of the planes a strong threaded shaft borne on ball-bearings is attached in a longitudinal position to the bottom of the fuselage. The shaft is prolonged behind the rear bearing and terminates in two concentric sprockets connected by chains to two wheels, likewise concentric, controlled by the pilot. Rotating the large pinion causes the shaft to revolve slowly, the small one causes a more rapid movement. On the shaft is mounted a large nut which is displaced forward or aft by turning the shaft to left or right. This nut is connected by two pivots to the rear uprights of the cellule. Movement of the nut, therefore, causes the cellule and the planes to which the cellule is attached to swing through an arc of from 0 to 12 degrees. The amount of rotation can be controlled within the smallest limits by the two handwheels.



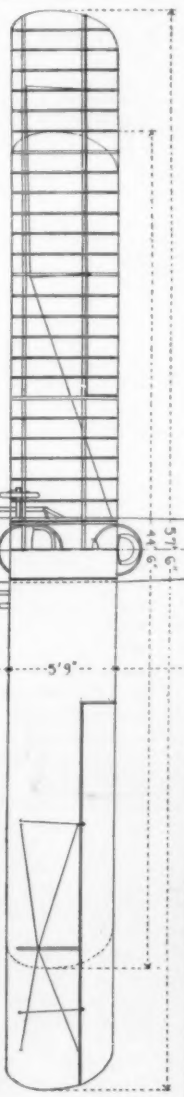
The landing gear is remarkably strong.

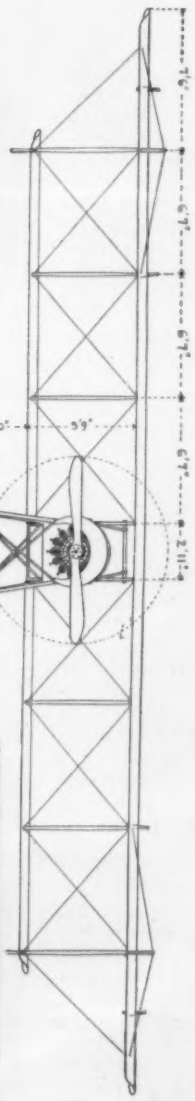
Note the plane-pivoting mechanism.

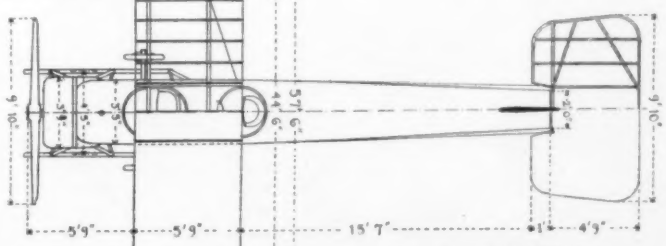




Threaded shaft with nut controlling the variation of incidence.







The Paul Schmitt biplane in flight.

The planes are divided into two parts each assembling into the central cellule. In all there are sixteen interplane struts suitably cross-braced in order to give sufficient rigidity to what constitutes a girder of fifty-seven feet span. The struts are profiled so as to give the minimum of wind resistance. Large ailerons are fitted to the rear of the upper plane. The elevator is very large, forming the entire tailplane. It is of the non-lifting type, i. e., perfectly flat, and can be swung through a comparatively large arc, thus aiding considerably the incidence variation of the main planes. There are two rudders, one above and one below the elevator. The rudders and elevator are, like the fuselage, composed of steel tubes covered with fabric.

The landing carriage is made up of two reinforced skids joined to the body by six struts diagonally braced. An axle slung from the skids by rubber shock absorbers carries four wheels. The strength of this construction is incontestable. A small skid is fitted at each extremity of the lower plane to take up the shock produced by a bad landing. There is also a skid placed below the rear of the fuselage to protect the tail plane and rudder.

The leading characteristics of the machine are as follows:

Upper span	57 feet 6 inches
Lower span	44 feet 6 inches
Length	33 feet 1 inch
Surface	484 square feet
Weight (empty)	1,430 pounds
Maximum speed	68 miles per hour
Minimum speed	22 miles per hour

The machine can start or land in an inclosure 400 feet long surrounded by a fence six feet high, the maximum distance required for taking flight or alighting being under 300 feet.

Early in March at Chartres Garaix began a wonderful series of height records, some of which were snatched away from him by Illner and Thelen, only to be recaptured by the pilot of the Paul Schmitt. On March 28th he established a record of 1,580 meters (5,182.4 feet) carrying eight passengers, 150 liters (33 gallons) of gasoline and 40 liters (8.8 gallons) of oil, making a total useful load of 758 kilogrammes (1,667.6 pounds). The record height was reached in 44 minutes, giving a vertical speed of over 35 meters (115 feet) per minute.

On March 31st Garaix established a final record of 1,590 meters (5,215.2 feet) with nine passengers. The same amount of gasoline and oil was taken as previously, the total useful load becoming 833 kilogrammes (1,832.6 pounds). The flight lasted 68 minutes, of which 59 were spent in climbing.

The Paul Schmitt now holds the following world's records for height:

Passengers.	Meters.	Feet.
4	3,150	(10,332)
5	2,250	(7,380)
6	1,750	(6,740)
7	1,600	(5,248)
8	1,580	(5,182.4)
9	1,590	(5,215.2)

The most wonderful flight of all, however, was made on the 22nd of April, when Garaix, carrying six passengers, broke twenty-seven records of speed, distance, and duration with two, three, and four passengers and created eleven new records. The 10-kilometer circuit was covered eleven times, making a total of 110 kilometers (68.2 miles) in 1 hour 2 minutes 25⅘ seconds. The total load was 620 kilogrammes (1,364 pounds), of which 465 were the pilot and passengers, 10 ballast, 105 gasoline, and 40 oil.

The new records established are given below, with speed, pilot, and six passengers: 10 kilometers (6.2 miles), 5 minutes 35 seconds; 20 kilometers (12.4 miles), 11 minutes 12⅕ seconds; 30 kilometers (18.6 miles), 16 feet 48⅕ seconds; 40 kilometers (24.8 miles), 22 minutes 28⅕ seconds; 50 kilometers (31 miles), 28 minutes 5⅖ seconds; 100 kilometers (62 miles), 56

minutes 44 seconds. Distance in one half hour: 50 kilometers (31 miles). Distance in one hour: 104.141 kilometers (64.6 miles). Greatest speed: 107.462 kilometers (66.6 miles) per hour. Duration: 1 hour 2 minutes 25⅘ seconds. Total distance: 110 kilometers (68.2 miles).

When Garaix established his height record for six passengers with 1,750 meters (6,740 feet) in 27 minutes he employed an angle of incidence of 7 degrees, while in his records of April 22nd, he used an angle of 1½ degree. The practical utility of the apparatus is thus seen at a glance.

The New British "Mark R. E." Biplane

By Major H. Bannerman-Phillips

THE aeroplane known officially as the "Mark R. E." biplane is the product of the Royal Aircraft Factory, Great Britain. At the Wilbur Wright memorial banquet in London on the 19th of May last, Colonel Seely, late Secretary of State for War, referred to this machine when he said, in responding to the toast of "Flying," that in his judgment the problem of stability of the aeroplane had been solved, since on the previous Friday he had taken part in a demonstration in which at the height of 2,000 feet the pilot abandoned all control, and he himself steered the machine about. There was a 28-mile an hour wind blowing when the experiment came off and the machine took the right banking and resumed its level flight. It is a tractor-biplane with four-bladed propeller. The engine used with it is a 120 horse-power Beardmore-Austro-Daimler. The letters "R.E." stand for "Reconnaissance-Experimental," and the machine is considered good even outside of government circles, which in regard to the flying machines of the Royal Aircraft Factory is not always the case. It is a modification of another well-known machine turned out by the Royal Aircraft Factory, the "B.E." or "Blériot-Experimental," of which a number are in use in the British air service. The question of publishing some of the aero-dynamical features of the construction has not been decided at present, but the military features will naturally be kept secret as long as possible, since the public interest demands it. It is, however, inherently stable and does not owe its self-balancing properties to any automatic control machinery. The object of providing for stability is not that it may be easier for an indifferent pilot to manage the machine, but in order that during the ever-increasing length and duration of flights for purposes of military reconnaissance the strain of constant balancing and control may be reduced to the lowest possible limits, and the pilot's energies economized to that extent, while at the same time, if he is required to do double duty as both pilot and observer, through casualty in war-time, he may be able to do so more easily than in a machine which requires greater continuous attention on the part of the pilot.

It may be observed here that the question of automatic or inherent stability is not so important in machines flown at considerable height, since the experiments of Pégoud and the imitation of his feats by others, in addition to sundry involuntary experiences on the part of sane airmen preceding Pégoud's attempts, have shown that, given sufficient room vertically, an aeroplane can be overturned and righted again without coming to earth by the efforts of the pilot. On the other hand, the close attention demanded of the aviator by a purely hand-controlled flying machine which is not inherently stable is very great during a long journey, and he is liable to be taken off his guard by a wind-gust occurring during a comparatively calm voyage, whether over land or sea. At the same time it must be remembered that the self-balancing aeroplane, so called, whether it owes its steadiness or stability to design and construction, as in the Dunne machines, or to automatic control, as when fitted with the Doutre stabilizers, has the defects of its self-righting qualities in that when the pilot does exercise full control, as for instance in turning or landing, it is apt to be sluggish in answering to that control, which under certain circumstances may be awkward and even dangerous. For instance, at maneuvers in Great Britain quite recently an officer of the Royal Flying Corps, who had chosen his landing-place and was coming down, suddenly became aware of a squadron of cavalry, who, in the course of a sham fight, were emerging from cover and charging across the open ground he had selected. By a supreme effort of skill and judgment he managed to avoid them, but one shudders to think of the havoc his machine would have caused if through want of skill on his part or slowness of the aeroplane in answering to the controls, it had been driven in among men and horses.

According to the London *Times* the King, the Queen, and Princess Mary recently paid a visit to the Royal Aircraft Factory and witnessed a flight by the "R.E." The passenger was Major Clive Wigram, Assistant Secretary and Equerry to the King, who was taken a flight of about 10 minutes without either controls, elevator, or rudder being touched.

Although the manner in which stability is maintained has not yet been made public, the *Times* ventures the following explanation:

"It is believed that in the present instance the rudder is spring-controlled, but that all other movements are due to the inherent stability of the design, which, expressed in other words, is this: A righting couple is formed, tending to restore balance when by any means balance is disturbed, and, in addition to this, if the flight path is disturbed, any oscillation which is set up is of the kind which dwindles down to nothing. If an aeroplane is stable laterally it must also be stable directionally, since the two are inextricably linked, but they may be considered separately to some extent. Any loss of lateral balance involves side-slip, and therefore side-slip is utilized to create the restoring couple. Side-slip produces a side wind on the "fin" surfaces of the aeroplane. These are made up of the lateral surfaces of the struts, wires, wheels, the fuselage, the propeller, and in addition there is a fin equivalent obtained from the dihedral angle between the wings. On all these surfaces the side wind acts, and if they are exactly proportioned there is enough top fin to give the righting moment. So far this has long been known and practised by aeroplane builders, but it does not give the stable aeroplane, as we may see by carrying the analysis a little farther. When the side-slip begins the whole aeroplane moves sideways relatively to the air, consequently the fin forward and the fin aft must be exactly balanced.

"If, as has so frequently been the case in the past, the fin near the rudder is too large, the side wind up it tends to throw the stern round, and, in the absence of the pilot's correcting action on the rudder, the machine "nose-dives." Conversely, with too small a fin aft, the same trouble arises in a different set of circumstances and produces the same awkward results.

"It is precisely in the calculation of the fin aft in relation to the fin forward that the directional stability so closely affects the lateral stability, and this linkage has, it is hoped, been made broadly evident by the above example.

"In longitudinal stability the difficulty is quite different. Longitudinally there are oscillations of the aeroplane on its center of gravity regarded as pivot, and there are oscillations of the whole mass on its path; both classes of oscillations must tend to die out.

"A matter of extreme importance in this connection is the alteration in the lifting force exerted by the wings. Unfortunately, when a dive begins, the center of lift of the wings tends to move backward toward their trailing edge, and this obviously aggravates the dive by lifting up the tail and depriving the front edge of the wings of their quantum of lift.

"To remedy this and to damp out oscillation is the function of the tail. Those machines which depend entirely on the pilot's sense of balance also depend entirely upon him to check the oscillations by appropriate movements of the elevator. Many an argument has taken place between those who, to give the pilot greater control, insisted upon the whole of the tail being mobile, and certain authorities who insisted that the damping effect on oscillations of the fixed portion of the tail was of priceless value to the pilot by giving him time to act. This point of view has to-day obtained far greater force in that the fixed-tail plane, if appropriately designed, can not only damp oscillation, but actually introduce the corrective moment necessary."

Business in the Patent Office

THE issue of patents on July 14th, 1914, appears to be the largest in the history of the Patent Office, and will include 907 mechanical patents and 23 design patents. During the past three months the receipts of the Patent Office have broken the record, the receipts for April, 1914, being $208,905.64; for May, $193,723.24; and for June, $198,508.79; or a total for the quarter of $601,137.67.

A comparison of the applications received in 1913 and 1914 of the Patent Office shows as follows:

Applications received during the fiscal year ended June 30th.	1913.	1914.
Applications for patents for inventions	67,986	69,311
Applications for patents for designs	1,930	2,441
Applications for reissues of patents	172	189
Applications for registration of trade-marks	7,053	8,146
Applications for registration of labels	926	1,016
Applications for registration of prints	344	436
Disclaimers	22	20
Appeals on the merits	1,651	1,696
Total applications, disclaimers and appeals	80,084	83,225

Autographic Kodak

THE latest invention in cameras is the autographic kodak, the conception of H. J. Gaisman, who also invented the auto-strop razor.

Heretofore, to keep a record of pictures has meant that the films must be marked in some way after they have been finished, or the prints must be marked.

With the autographic kodak the record can be made with one operation immediately after the picture has been taken. The film is marked in the kodak.

The autographic kodak uses what is called the autographic film cartridge. This is made with a thin red instead of the familiar thick red and black (duplex) paper. The thin red paper is not lightproof in itself, but between it and the film is inserted a strip of tissue. This tissue serves two purposes: to supplement the red paper in lightproofing the cartridge, and to permit the recording, by light, of the writing upon the film.

The autographic kodak has a spring door on the back, covering a narrow slot through which the writing is done upon the red paper. The slot is provided with an automatic safety spring border which operates when the door is open to press the papers into contact with back of the film, thus securing the sharp printing of the image of the writing and preventing the diffusion of light around the edges of the slot. This slot is located so that normally the writing comes between the exposures.

After the picture is taken, the door is opened, and with a stylus which is provided, or a smooth pointed pencil, held in as upright a position as is convenient, the photographer writes on the strip of exposed red paper any memorandum desired, such as the title of the picture, the date, or details regarding exposure, light, stops, etc.

The action of the stylus or pencil so affects the tissue as to permit the light to record the writing upon the film. After finishing the writing, the door should be left open for the printing, in accordance with a table for varying degrees of light. The exposure is made to the sky, but not to the sun.

The result is a negative, bearing a facsimile of the memorandum written upon the back of the red paper, developed on its margin or face as the case may be, the writing appearing in the foreground of a vertical picture or on the left side of a horizontal picture.

Do the Planets Affect Our Weather?

ONE of the correspondents of the Weekly News Letter to Crop Correspondents published by the Department of Agriculture wants to know whether the positions of the planets have any effect on the weather. The following is the News Letter's answer:

A few people strongly assert that they do, while many others have their doubts. Those, however, who have given the subject careful attention are positive that none of the planets, nor even the moon, ever has any appreciable effect on the weather.

As a matter of fact, all weather changes depend ultimately upon temperature differences. The temperature, as we know, constitutes of itself a most important weather factor. Another and equally important weather factor is rainfall. But to obtain rain it is necessary first to evaporate water from the surface of the earth, and this, as everyone knows, requires heat. Still another important weather factor is the direction and force of the wind, and this, too, requires heat, for the winds will not blow unless the temperature is different at one place from what it is at another, any more than the air will draw up a chimney when there is no fire in it.

Since then the heating of different parts of the earth and its atmosphere to different temperatures is the real cause of the winds and of all weather changes it follows that the moon and the planets can affect the weather only so far as they supply heat.

Now, according to accurate measurements made with the most delicate instruments, the amount of heat sent to the earth by all the planets and also by the moon is insignificant in comparison to the amount that comes from the sun. Hence, we could not expect either the planets or the moon appreciably to affect the weather. They do not supply enough heat, the one thing that causes all our weather changes.

To most people the foregoing reasoning may seem quite sufficient and conclusive, but there is still another and an entirely different method of testing the whole question. We can observe the positions of the planets and the kind of weather during each position and see whether the same sort of weather always comes when the planets are in the same position. This kind of examination has often been made, both for the planets and for the moon, but not the slightest influence of either upon our weather has ever been found.

To sum up: We have every reason to believe that neither the planets nor the moon can have any appreciable effect on the weather, because they furnish so little heat upon which all weather changes ultimately depend, and this belief is fully supported by weather records.

The belief, still to be found in all countries, that the planets and the moon do affect the weather never had any scientific basis whatever; it is only a remnant of the many superstitions generated and fostered by that other and greater superstition, astrology.

The Wireless Outfit of the "Imperator" comprises three separate stations; one of 15 kilowatts, for long-distance work; one of 3 kilowatts, mainly for communicating with vessels at moderate distances; and an emergency station worked by a powerful storage battery. The main station can exchange signals directly with the large land stations of America or Europe during the whole of the transatlantic voyage, so that the delays involved in relaying messages from ship to ship are avoided. In midocean the ship is in communication with both the German station at Norddeich and the American station at Sayville. The emergency station, intended for use in case of a stoppage of the ship's dynamos, is capable of operating for six hours.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Sanitary Swimming Pool

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of June 13th appears a very interesting article on the sanitation of swimming pools. This section of Florida has numerous lakes and so-called sulphur springs. These have always been considered clean and sanitary, but I noticed at one of our largest springs, a lot of floating moss remaining stationary outside of the "boil," showing that a good deal of this water remained in a dead space. The rocks in these springs are covered with this slimy moss, and it is reasonable to assume this moss is an ideal breeding-ground for bacteria. Our lakes and rivers contain moccasins, leeches, stingrays, etc., and are therefore not safe; but the most danger lies in the warm, shallow water at the edges, which in this warm climate smells strongly of decaying bacteria and vegetation.

I have a shell-mound located on the St. John's River and Lake Monroe, three miles below the city of Sanford. The ground is covered with immense live oaks, tall palms, etc. Four years ago I cleared off the underbrush, logs, stumps, and superfluous trees, fenced the land, built a small dock for boats to land, put in various cheap amusements, and built the most sanitary pool I have seen yet. A pit from which shell had been shipped for road paving was dug out deeper and on straighter lines up to the edge of a number of large live oaks, the bottom cemented, and the walls built of wood framing fastened to these big oaks and covered on the inside with galvanized sheet-iron, well painted. This is filled from an artesian (sulphur) well, which has enough pressure to allow a strong shower-bath also. As the population is small, this pool is used only two days in a week, and is emptied after each day's use, the water being used to flush the toilets. The following days, sun and air thoroughly disinfect the empty basin, which is then swept out and refilled over night with pure water from the artesian well. Rooms and suits are sprayed with a good disinfectant. The trees around the edges give the pool a natural "swimming-hole" appearance. Diving stage, toboggan slide, etc., add to the pleasure of bathing. The pool is 85 by 30 feet, but irregular in shape, to preserve the trees for shade over the pool. Depth of water is 3 feet 6 inches at one end, increasing to 5 feet 6 inches at lower end, therefore perfectly safe for children to learn to swim. The water from well is 73 deg. Fahr., but warms 8 to 10 degrees in the pool on a warm day. The amusements on the grounds are nearly all original, and would take too much of your space to describe them, but they give great pleasure.

V. SCHMELZ.

Sanford, Fla.

Energy from the Sun

To the Editor of the SCIENTIFIC AMERICAN:

Unless I am greatly mistaken, the writer of the critique bearing the above title in your issue of the 23rd of May, 1914, is much indebted for his statements to a similar article which appeared on page 495 of *Engineering* (London) of 10th of April, 1914, and this indebtedness extended not only to facts, but also the several mistakes or misleading statements which I had to write and correct, as you will see by the correspondence columns of *Engineering* of 24th of April, 1914, where it is pointed out that the original paper carefully called attention to the fact that the engine-end of the Meadi plant (which has nothing to do with the utilization of solar energy *per se*) was in a very bad state; that, consequently, the pump horse-power had not been given in the official report, and that, in order to make a fair and scientific estimate of the brake horse-power per acre, the results of the Meadi absorber had been combined with those of the Erith engine. This being done, it is shown that the best hour's run on August 22nd, 1913, gave 55.5 brake horse-power for an area of 0.88 acre occupied by the absorber = 63 brake horse-power per acre, while the average power for the five hours' run on that day was 59.4 brake horse-power per acre. This same method of combining two sets of results had to be adopted in the case of the Tacony trials of 1911, and for the same reason. The writer of the article in *Engineering* of 10th of April, 1914, quoted the figure (18.54 brake horse-power = 45.2 brake horse-power per acre) thus obtained for the Tacony absorber, but did not compare it with the corresponding figure (59.4 brake horse-power per acre) for the Meadi absorber, and consequently arrived at the erroneous conclusion that "somewhat better results were obtained in some previous trials near Philadelphia," i. e., at Tacony. This, it will be seen, is far from being the case, even on the basis of the area of land occupied by the absorbers, though in my opinion it is the steam produced per square foot of radiation that is the scientific basis of comparison, and on this the Meadi results are shown on page 108 of my paper to be 33 per cent better than the Tacony ones.

The same article also refers to "the great variability in the rates of power produced." Taking the five-hour run on August 22nd, 1913, the maximum brake horse-power was 55.5, and the minimum 46.2, or a total decrease of 16.8 per cent. This was far less than (67.9 per cent) in the case of the Tacony absorber, and less than was anticipated; but when the power is used for irrigation purposes it matters extremely little that more water is pumped during the mid-day hours than in the morning and afternoon. In addition, it should also be noted that the plant gave the best commercial result when working at a steam pressure of 4½ pounds per square inch by gage.

Your journal has (as the bibliography at the end of my paper indicates) for so long been well supplied with information on this subject, that I am sure you will like to have the data as correct as possible, and that, consequently, you will be good enough to give this letter as much prominence as the article in your issue of 25th of May.

A. S. E. ACKERMANN.

London, England.

Conditioning of Textile Materials

To the Editor of the SCIENTIFIC AMERICAN:

In his article on "Science and the Tariff," which appears in your issue of June 27th, Dr. E. E. Pickrell gives a very accurate and interesting account of the method of determining the moisture in cotton yarn and cloth under the Underwood tariff law, but fails to call attention to the long neglect of this matter by the Treasury Department, and to the great need of scientific investigation of moisture regain for textile materials at the present time. Drying out textile materials and then adding a certain percentage to the dry weight in order to bring the total weight to a standard agreed upon, are very simple operations, called "conditioning," which was adopted by the French silk trade 146 years ago, and later was adopted for wool, cotton, flax, and other materials in order that the buyer of textiles by weight might always pay for a uniform quantity of water. The moisture present in textile fibers varies with the temperature and humidity, so that unless the material is conditioned the weight, and consequently the cost when sold by weight, vary with the weather.

On March 2nd, 1861, a cotton tariff law was enacted, under which the classifications were so arranged that the duties rose and fell as the weight varied with the moisture present. Except for the eleven years from 1883 to 1894, this has been the case under our textile tariffs ever since, but not until October of last year was there any attempt to condition cotton textiles for tariff purposes. Cotton duties rose and fell with changes in temperature and humidity, and apparently the Treasury officials were not aware of the fluctuations. This is the more surprising because the remedy was the adoption, not of a complicated and highly scientific process, but the very simple practice of conditioning, with which the textile trade had been familiar for more than a century. With the Treasury officials themselves awakened so recently to the conditioning of textile goods, it is not surprising that but few of the general public know about the practice.

The moisture present in textiles varies not only with temperature and humidity, but also with the kind of material, so that different standards for moisture regain have been adopted: 8½ per cent for cotton; 11 per cent for silk; and 18¼ per cent for wool tops. These standards have been adopted by the European trade to conform to weather conditions in Europe. The 8½ per cent standard for cotton and the 11 per cent for silk are recognized in all parts of the world, but the conditioning standard for wool varies in different localities, Bradford, England, accepting 18¼ per cent, while Mazamet, France, recognizes 17 per cent.

These variations for wool and the occasional agitation to establish regain standards in the United States for other materials, differing from the foreign standards, make it necessary that the regain at different degrees of temperature and humidity be determined with scientific precision. The best known tests for this purpose are those made by Th. Schloesing fils, Paris, and by W. D. Hartshorne, Lawrence, Mass. The former tests were made by a scientist at the request of French manufacturers, but are not extensive enough to meet present needs. The latter were made by a mill manager in his mill, and are thus subject to the unavoidable errors that accompany research work carried on under such conditions. Extensive tables for both wool and cotton have been based on Hartshorne's observations, but it was undoubtedly necessary to force the values for wide spaces, as his observations included only the actual variations in the weather at Lawrence.

What the textile trade needs to-day is an exhaustive series of tests to determine the moisture regain for the different textile materials for every possible combination of temperature and humidity in the entire range of weather variation throughout the world. This work should be done by scientists of unquestioned ability under conditions free from trade influences and calculated to give the highest possible degree of accuracy regardless of its effect on arbitrary trade standards. The data thus obtained and the observations of the U. S. Weather Bureau would enable conditioning standards to be intelligently established for textiles. This is scientific work that would be of great and permanent value to the textile industry, not only of the United States, but of all countries. It comes within the scope of the National Bureau of Standards, as defined by the law creating that bureau, and its successful accomplishment would be a mark of distinction for any scientific institution. Instead of pointing with pride to the belated adoption in 1913 of the old and well-known operation of conditioning, government scientists should recognize their long neglect of the question and be stimulated to do real and important scientific work in connection with the moisture regain of textile materials.

Boston, Mass. SAMUEL S. DALE.

Reduction

To the Editor of the SCIENTIFIC AMERICAN:

It is said by astronomers, reduce ninety-two million miles, more or less—in other words, the distance from our earth to the sun—to one inch (and that is surely some reduction), then we would have to travel five miles to reach the nearest fixed star, possibly a nucleus for another solar system. Does not such contemplation also reduce our ego?

But maybe the cynic proclaims: "When he beholds a great puffing gas buggy, a cardinal red chariot approaching, yclept touring car, ensconced therein a bespectacled, somewhat chesty individual; may he be permitted to imagine this mighty man as an 'apendectomologist'?" Be that as it may, the time has arrived when no longer can we look wise and say nothing. The people demand value received. My prognosis is, that specialty will predominate, and we shall arrive at a point when reduction in the number of practising physicians will be necessary for the welfare of the profession at large, and to retain due respect from the observing laity; then will be found a composite practitioner and eminent scientist, steeped as it were in medical lore, who must possess a mentality for genius, combined with a large percentage of common or horse sense, and he will operate the diagnostic values alone. His clientele will be placed, after his first inspection, under the care of the medical specialist, surgeon, or super-trained nurse. At the present time, trained nursing does not meet with the consideration and importance that it should. The responsibilities should be divided up more, between the immediate and continuous attendant upon the sick and the visiting physician, when there will be less excuse perhaps for the shifting of responsibility, or the relying on youth, in shape of the newly graduated, to carry out orders from the more experienced, and then again transmitted to the trained nurses. This system is faulty and open to argument.

Let us even change titles to modern needs. An "experienced disease expert," under the supervision of a scientific and thoroughly posted professional, would sound better than doctor or doc. The said professional would not visit his patient so often; awaiting to be called upon by the disease expert, thus saving time, energy, and the income of his client.

My motive in advancing a theory of reduction is not by any means a criticism of present methods, merely a note of warning to the profession. If we allow so numerous a proportion of doctors of medicine, and doctors of "what-not," then there is but one end—degeneration and cheapness; dragging down the worthy back to the conditions when a tonsorial artist and a blood letting chirurgeon were one and the same. In other words, make it difficult to attain a title that should carry with it every mark of respect. Have national examinations at intervals by a competent board. These mental endurance tests would correspond with the present physical tests of fitness for other known Government employees. Further, when a grievous mistake in diagnosis is made, and wrong treatment followed by disaster to the patient, then some redress should be obtainable for this patient. Too many upstarts, whose main asset is their colossal assurance and conceit, have injured the profession already; and it is high time for that profession itself to look to its own welfare, and not depend upon outsiders, who criticise, but do not lend a helping hand.

The above was suggested to my mind by a remark made by a merchant acquaintance, who being grieved over the death of his child, said that the Pure Food and Manufactured Goods Law should apply to doctors' mistakes.

J. A. GUTHRIE, M.D.

Surgeon United States Navy, Retired.

Portsmouth, Va.

Completing the Ashokan Reservoir

Storing a Supply of 500,000,000 Gallons Per Day of Mountain Water for New York City

IN spite of the fact that the present Croton dam and the old and new aqueducts are capable of supplying New York with nearly four hundred million gallons of water per day, so rapid is the growth of the city that it became necessary, several years ago, to find an additional source of supply, which would cover the needs of the city for many decades to come. After an exhaustive examination of all possible sources of supply by an expert board of hydraulic engineers, it was decided to utilize the excellent drinking water of the streams of the Catskill Mountains. The site for the main dam was selected in the valley of Esopus Creek, to the west of the Hudson River, at a point some ninety miles from New York. The first construction work on the Ashokan reservoir was begun September 30th, 1907, and the whole work will be completed by December, 1915.

The putting through of the scheme for the new Catskill water supply, and the organization of the work on a basis which would free it from political interference, was one of the most notable achievements of Mayor George B. McClellan; and the Board of Water Supply, as thus organized, is to be congratulated on the uninterrupted progress of the work, and the efficiency with which it has been carried through under the leadership of its chief engineer, J. Waldo Smith, and his able corps of consulting and departmental engineers.

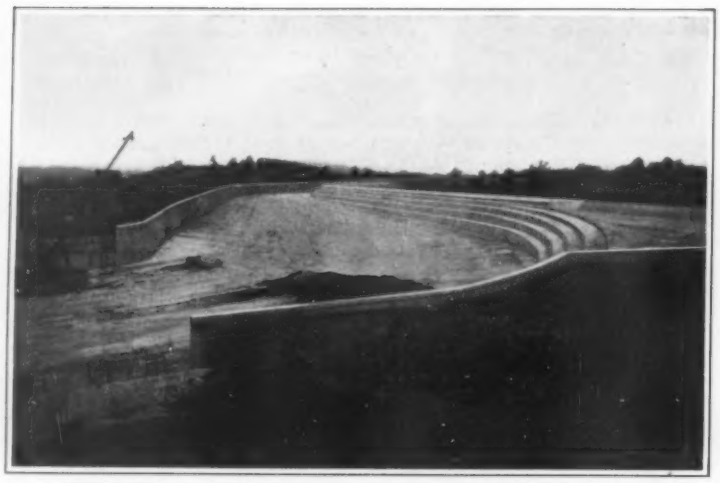
The estimated cost of bringing the water to New York was $161,857,000. Subsequently the scheme was enlarged to include the delivery of Catskill water to all the boroughs of the city, including those of Manhattan, Queens, and the Bronx, and this increased the estimated cost by $15,000,000.

The four watersheds from which the supply is to be drawn are situated west of the Hudson River in the Catskill Mountains, and lie between 75 and 135 miles from New York City Hall. These watersheds have an aggregate area of nearly nine hundred square miles. For the present, the supply of the Esopus watershed, which embraces an area of 255 square miles, will be utilized. When it becomes necessary to take in the other watersheds, Schoharie can be tapped by means of a tunnel through the dividing range, and the Rondike and Catskill watersheds can be made to contribute their quota, the first directly to the main aqueduct to New York by what will be known as the Rondout aqueduct, and the latter by an aqueduct from Catskill Creek, which will lead into the Ashokan reservoir. From this gathering ground it will be possible, in a series of unusually dry years, to draw seven hundred and seventy million gallons daily the year through.

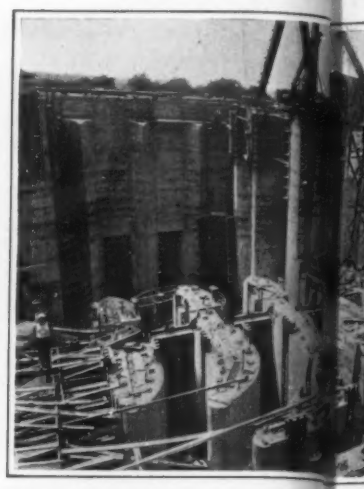
The most important reservoir of all, when the four watersheds shall have been developed, will be that at Ashokan, which has been formed by the construction of a great masonry dam across the Esopus Valley, which is known as the Olive bridge dam. From Ashokan reservoir to the city's northern boundary there are 92 miles of aqueduct, and it is 127 miles from the reservoir to the borough of Richmond, Staten Island.

In addition to the Ashokan reservoir, which has a capacity of one hundred and thirty-two billion gallons, another large reservoir is being built at Kensico, east of the Hudson and twenty miles north from City Hall, which will have a capacity of thirty-eight billion gallons. This will act as an emergency storage reservoir, so that in case of inspection, cleaning, or accident to the seventy-seven miles of aqueduct between Kensico and the Ashokan reservoir, it can act as an emergency storage reservoir. The cost will be $8,500,000. The third reservoir, which will be known as the Hill View reservoir, is being constructed in the city of Yonkers, just over the New York city line and 15 miles south of the Kensico reservoir. It will hold nine hundred million gallons of water, and its duty will be to equalize the difference between the use of water in the city, as it varies from hour to hour, and a steady flow in the aqueduct. Also it will furnish a large amount of water upon immediate demand, such as would occur in the case of a great conflagration.

Ashokan reservoir consists of two large basins known as the east and the west basin. The west basin lies in the valley of the Esopus, and the east basin, which is divided from the former by a weir, has been formed in a natural basin among the hills, the depressions being closed by a vast system of huge earthen dikes having a total length of 5½ miles. The keynote of the whole of these vast works is the Olive bridge masonry dam, which is 4,660 feet long, 220 feet high, 119 feet thick at the base, and 23 feet thick at its crest. The west basin formed in the valley of the Esopus by this dam has a total capacity of fifty billion gallons of water. The east basin has a maximum capacity of eighty-two billion gallons. The water surface of the whole reservoir is 12.8 square miles, and for the



The waste weir, over which the surplus waters of the reservoir are discharged.

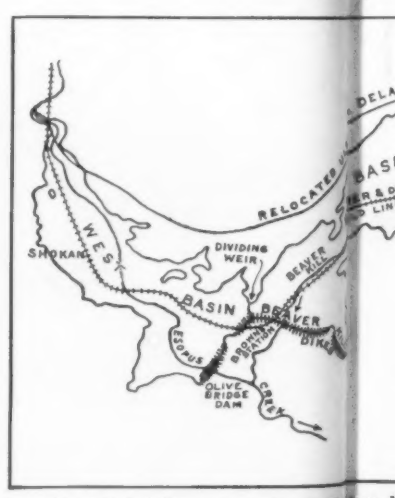


View showing elaborate construction

View from downstream of Olive bridge dam, showing temporary tunnel for flow of Esopus Creek.

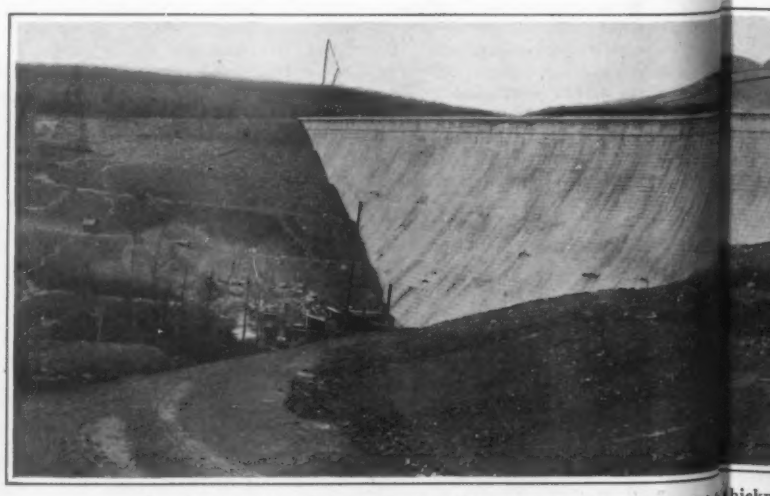
A 200-foot span arch bridge for

Handsome reinforced five-arch concrete bridge across Esopus Creek, upper end of Ashokan reservoir.



Map of Ashokan reservoir, showi two the dam likes.

West face of upper gate chamber, Ashokan reservoir.



The Olive bridge dam—Length of dam, 4,650 feet; height, 22 thickn 132,000, illons

ASHOKAN RESERVOIR—A MONUMENTAL WORK IN THE CATSKILLS FO PLY

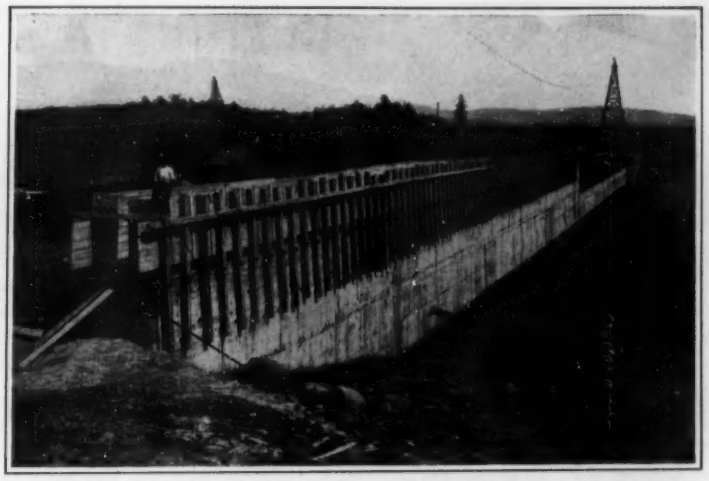
ruction wntake chamber of the Hill View

for ne new driveway around reservoir acreage.

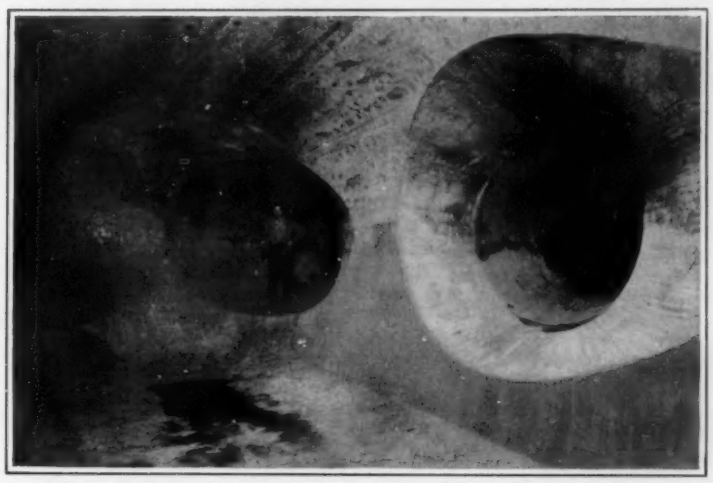
howi two basins and the location of e dam ikes.

Thickness at base, 190 feet. Capacity of reservoir, allons.

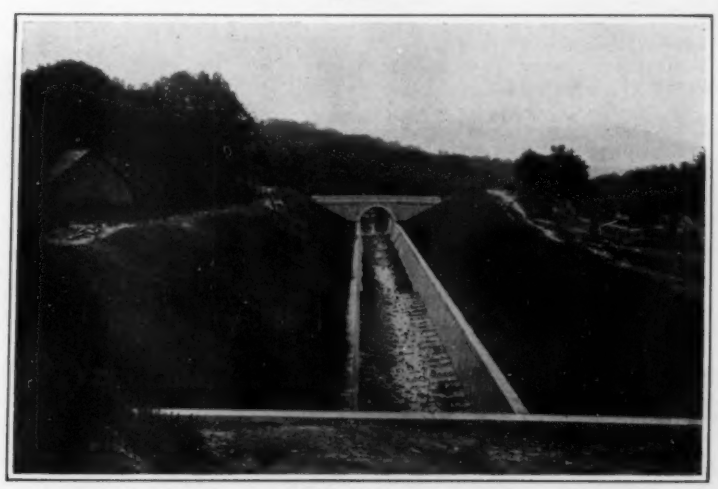
PPLYING NEW YORK DAILY WITH 500,000,000 GALLONS OF WATER.



One of the main earth dams, showing construction of core-wall, which is carried down to rock.



Upper gate chamber. Outlet from 60-inch valves at junction with low-pressure aqueduct.



View looking through the waste channel to Beaver Kill bridge.

Traver Hollow bridge during construction.

construction of the reservoir no less than 15,222 acres of land were acquired. The length of the reservoir is twelve miles, and the length of the shore line is forty miles. As showing what this quantity of water means, it may be stated that it would be sufficient to cover the whole of Manhattan Island to a depth of 28 feet, and that the area of its surface would be equivalent to that of the whole of Manhattan below 116th Street.

The main Olive bridge dam of solid masonry was carried down everywhere to solid, impervious rock. An interesting feature of its construction is that it is built in sections, with vertical expansion joints running entirely through the structure in an up-and-down-stream direction, which permit of changes of length, due to variation of temperature, and eliminate those stresses which, in a continuous dam, result in minute cracks through which seepage may occur. The miles of earthen dikes form a most impressive spectacle. Each of the dikes consists of a central masonry core-wall, carried down to solid rock, backed on both upstream and downstream sides with huge masses of clean earth from which all boulders have been picked, the earth being laid in 6-inch layers, and thoroughly compacted by heavy steam rollers.

One of the most important works is the spillway and waste weir with a crest elevation of 587 feet above sea level. The length of the crest is 990 feet, and the water which is wasted over the spillway flows through an open channel to empty into Esopus Creek, 2 miles below Olive bridge dam. Another massive and picturesque construction is the weir dividing the west and east basins, which is spanned by a 15-arch bridge 1,270 feet long. Although the construction of the dams and dikes, massive and complicated headgates, etc., forms the major portion of the work, the construction of the reservoir involved a vast amount of preliminary work as the following statistics will show:

In the first place, the whole of the bed of the reservoir had to be cleared of all vegetation, trees, villages, and buildings. No less than seven villages were submerged, the total population of which amounted to 2,000 souls. Thirty-two cemeteries were removed and 2,800 bodies had to be taken up and re-interred. The Ulster and Delaware Railroad originally ran through the Esopus Valley, and this had to be relocated on the high land adjoining the reservoir, a work which involved a relocation totaling 11 miles. Furthermore, 64 miles of highways had to be discontinued and 40 miles of new highway of the very finest bituminized macadam have been built around the reservoir. This highway has involved the construction of no less than ten reinforced concrete bridges. We illustrate two of the most handsome of these—a five-span bridge over Esopus Creek and a 200-foot single span bridge across Traver Hollow. These bridges are of reinforced concrete and, as our illustrations show, they are of excellent and appropriate design, adding greatly to the generally picturesque appearance of the landscape immediately surrounding the reservoir.

A most important and commendable work is the clearing and reforestation of a belt of land about 1,000 feet in width entirely surrounding the reservoir. The existing woodlands are being cleared of all dead timber, young trees are being planted, and, in the course of time, this reservoir with its belt of forest land and its magnificent roadway will form one of the most picturesque automobile drives to be found in the United States.

The work of building the reservoir has involved the excavation of nearly three million cubic yards of earth and rock, the placing of over eight million cubic yards of embankment, and of nearly one million cubic yards of masonry. The work of building the dam has employed steadily an army of about 3,000 men, who have lived, many of them with their families, in homes built by the contractor near the works. In this camp, which is a model of its kind, there is up-to-date sewerage, a water supply system, excellent dwellings, with screens on all doors and windows, well laid out streets, electric lights, telephones, savings banks, hospitals, police, fire protection, a Young Men's Christian Association, and a post office. The maximum population at one time was approximately 4,500 people.

Our thanks are due to the department engineer, Alfred D. Flinn, Department Engineer in New York, and to George G. Honness, department engineer on the reservoir, for courtesies extended in the preparation of this article.

Humboldt's Correspondence.—Prince Roland Bonaparte has presented a work entitled "Lettres inedités de Humboldt." The letters are addressed to Aime Bonpland who was for four years the companion of Humboldt in his celebrated journey across America, and who, on returning to France, became intendant of the Empress Josephine, at Malmaison, then in 1816 set out for Paraguay. He settled down in the Argentine Republic, and kept up an active correspondence with Humboldt till his death.

The mouth of the "bottomless pit."

The basin, showing the pit at the far end.

Looking down into the pit.

A Bottomless Pit

By Henry H. Riggs

THE road between Chermonk and Chunkoush, in the Turkish province of Diarbekir, passes through a limestone region where the rains and floods of ages past have washed the rocks into a thousand grotesque and unexpected forms. Caves and cavities of all shapes and sizes abound. One of these caverns is of more than usual interest. About midway between the two towns named the road crosses a broad valley, which slopes gently toward the southwest. The drainage water of this valley forms, in the wet season, a small stream, which, in time of heavy rains, becomes a torrent of no small size.

At the point where the road crosses this valley, the stream has cut for itself a channel in the floor of the valley, which grows a little farther down into a deep, rocky gorge, and finally ends in a basin fifty feet deep and two hundred feet or so across. Climbing down the deep side of this basin, one comes at the bottom to the mouth of a vertical sink-hole into which the stream plunges and disappears. The mouth of the cavern is about eight by fifteen feet in size, and from the edge appears to be perfectly vertical, somewhat larger below than at the mouth. No hint of the bottom is visible.

When first visited by the writer in April, the spring torrent plunged into the cavern, and little could be seen or heard but the deafening cataract. A recent visit, in October, gave better opportunity for examining the cavern. There had been no rain since spring, and there was no stream at all. Looking down from the edge, the overhanging sides of the cavern could be seen for a considerable depth, but the cavern broadened out below, giving the impression of enormous width and depth. Stones were dropped into the cavern to determine its depth. As a stone gathered headway, the whirring of its flight through the air, reflected and multiplied by the walls of the cavern, came up like the roar of a storm in the forest.

A heavy stone, nearly spherical, dropped from the hand, fell for four and a half seconds before striking anything. This, after allowing for air resistance and the time taken for the sound of impact to reach the ear, would indicate a straight drop of more than 300 feet. After the first impact, however, the stone dropped for another two seconds before it touched again, and bounded on down for another two seconds before coming to rest. If, as seems probable, the first impact was a glancing blow which did not materially retard the fall of the stone, the second impact must have been not less than 650 feet from the mouth, and the bottom may have been two or three hundred feet lower yet. This is a prodigious depth for a practically vertical drop, and the spring torrent plunging down from that height would be a notable waterfall were it not hidden from view.

An interesting problem is where this subterranean channel discharges. In times of heavy rain the torrent rushes into the cavern in such volume that the opening is completely filled, and the bottom of the basin becomes a seething vortex, into which the turbid waters carry boulders of no small size. No springs in that neighborhood show signs of discharging these flood waters. The natives of the region have tried the experiment of dumping chopped straw into the stream and watching for its reappearance in streams below, but without result. The valley slopes gently away to the Euphrates River, fifteen miles away, and it does not seem possible that this cavern has any outlet at any point nearer than that. Here is an opportunity for someone in search of interesting adventure to descend this pit and explore the cavern to its outlet or outlets. He might find a very extensive underground world, which the eye of man has never seen.

New Type of Tire Chain

IN many cases it is useless to apply the ordinary pleasure car type of tire chain to the dual wheels of heavy motor trucks, on account of the relative inelasticity of solid rubber tires and the enormous weight carried. Furthermore, the cutting action of the rim flanges prohibits the use of any chain device passing around the tires. A stationary device or ordinary cable chain warped around the tire and striking the same spot continuously, will cause a deep cut in the tire.

With these facts in mind the anti-skid device here illustrated was developed. It consists of drop-forged steel cross-pieces or frogs, specially treated to give tough wearing qualities, connected by tested links to form a continuous chain between the dual tires. Provision is made for taking up slack of the chain in consequence of the wear of the tires. The cross-pieces are not stationary, but constantly change their position, so that wear on the tire is uniformly distributed. The non-skid device is easily attached and detached without jacking up the truck, while the shape of tread insures perfect traction and absolutely prevents skidding. It is claimed that the device cannot damage any part of the wheel, and being fitted between tires cannot foul the driving chain.

Anti-skid chain for dual tires.

A Shooting Field Glass

A NOVEL weapon for marksmen and hunters has recently been developed. The invention consists of a pair of telescopes in unit adjusted to a short rifle between them. The telescope may be easily detached and used individually without the gun. The gun is steadied and rested against the forehead by means of a recoil pad. The recoil is taken up by means of a series of flat springs arranged like a carriage spring, one leaf on top of the other, and a soft leather padding, which in aiming is rested against the forehead, steadying the gun. On guns with an extremely heavy recoil, shoulder stocks are used in addition. Using two telescopes, a perfect stereoscopic picture is obtained. The full power of a man's vision is in use while aiming. It is claimed that accidents which have so often occurred should now be reduced to a minimum, as one may easily distinguish what he is aiming at.

Mr. Demele, the inventor, conceived of the binocular telescope gun while on an extensive hunting trip in northern Quebec, when he saw what appeared to be a bush moving in the distance. With the aid of his field glasses he detected the cause of it to be a bear scratching the ground in the dense brush. He dropped his glass and raised his rifle for a shot, but missed his bear, as he expected. This suggested to him the advantages of being able to shoot with the aid of a glass.

The gun used for experimenting is shown in the photograph and has a range of 1,500 yards and a penetration of ⅜-inch boiler steel at that distance. Two hundred shots were fired in rapid succession with astonishingly good results.

A shooting field glass.

Why Popcorn Pops is not fully understood, says a recent bulletin of the Agricultural Department. Formerly it was supposed that the popping resulted from the expansion of oil in the kernel on being heated, but more probably it is due to the expansion of moisture contained in the starch cells. This moisture expands, when heated, with sufficient force to cause an explosion of the cells and the kernel turns completely inside out, enveloping the embryo and hull. Probably the expansion of the air within the seed coat also plays some part in the process.

A MOST EFFECTIVE INSURANCE AGAINST MOTOR CAR THIEVES IS THE COMBINATION LOCK HERE SHOWN. THE GASOLINE ON ITS WAY TO THE CARBURETOR MUST PASS THROUGH THIS LOCK WHICH CONSISTS OF A SERIES OF VALVE PLUGS EACH FITTED WITH A DIAL. ONLY WHEN THE DIALS SHOW A CERTAIN COMBINATION ARE ALL TURNED TO THE RIGHT POSITION TO PROVIDE AN UNINTERRUPTED PASSAGE FOR THE FUEL.

WHEN A CAR LEAVES THE FACTORY ITS SPRINGS ARE SPREAD WITH GREASE BETWEEN THE LEAVES, BUT THIS, IN TIME, SQUEEZES OUT, AND THE SPRINGS BECOME STIFF AND SQUEAKY. IN ORDER TO RETAIN THE GREASE, THIN PERFORATED PLATES ARE INSERTED BETWEEN THE LEAVES; THE PERFORATIONS FORM GREASE RESERVOIRS.

TO ELIMINATE THE DIFFICULTIES OF PRESSURE FEED FROM A REAR TANK A VACUUM FEED HAS BEEN DEVISED. AN AUXILIARY TANK IS LOCATED ON THE DASH, AND FROM IT THE GASOLINE FLOWS TO THE CARBURETER BY GRAVITY. THE TANK IS AUTOMATICALLY CONNECTED WITH THE MANIFOLD, SO THAT ITS SUPPLY IS REPLENISHED PERIODICALLY. A DETAILED DESCRIPTION IS GIVEN ON PAGE 49.

A PARIS INVENTOR HAS DEVISED A WINDSHIELD WHICH DEFLECTS THE HEAD WIND AND CAUSES IT TO PASS OVER THE DRIVER'S HEAD. THE AIR CURRENT ITSELF ACTS AS A SHIELD AND THE DRIVER MAY CLEARLY INSPECT THE ROAD UNHAMPERED BY ANY GLASS PANE. THE DEFLECTOR MAY BE RAISED TO CONNECT WITH THE MOTOR CAR TOP IN CASE OF RAIN.

IN ORDER THAT A MAN MAY RAISE AN AUTOMOBILE TOP UNASSISTED, A PROP IS NOW PROVIDED WHICH ENGAGES UNDER THE SECOND BOW CENTER, WHILE THE TOP IS SWUNG UP AND FORWARD INTO POSITION. THE PROP CONSISTS OF A ROD AND TUBE HELD IN EXTENDED POSITION BY A SPRING, AND TELESCOPING INTO A SMALL PARCEL WHEN NOT IN USE.

AN INEXPENSIVE ILLUMINATED LICENSE PLATE FOR AUTOMOBILES IS PROVIDED BY A RECENT INVENTION. A STENCIL NUMBER PLATE IS USED. LIGHT FROM A TAIL LAMP FALLS UPON A REFLECTOR AND SHOWS THROUGH THE PERFORATED NUMBERS. THE PLAN VIEW, IN THE INSERT, INDICATES HOW THE REFLECTOR MAY BE MOVED TO THE DOTTED POSITION IN THE DAYTIME TO PROVIDE A BRIGHT BACKING.

ORDINARY INNER TUBES BURST WHEN INFLATED TO 85 POUNDS, UNLESS PROTECTED BY A SHOE. HERE IS A TUBE THAT WILL STAND 80 POUNDS WITHOUT BURSTING, SO THAT SHOULD THE PROTECTING SHOE GIVE WAY, THERE WILL BE NO BLOWOUT. IT HAS A REINFORCED TREAD SO THAT THE CAR MAY ACTUALLY RUN ON THE BARE TUBE, SHOULD THE SHOE WEAR THROUGH IN ANY SPOT.

SOME RECENT AUTOMOBILE ACCESSORIES.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SHOULDER BRACE.—E. F. SMALL, 1402 Candler Building, Atlanta, Ga. The invention relates to body braces, and more particularly to a shoulder brace, the object being to provide a light sanitary brace particularly adapted for women's wear, which may be readily adjusted to fit, and will automatically adjust itself in accordance with the body movement of the wearer.

SAFETY CUFF BUTTON SHIRT.—J. FALKENBERG, 846 E. 86th St., New York. A common objection to soft shirts is the danger of losing valuable cuff buttons. To avoid this danger, the present invention provides a safety attachment for a soft shirt cuff which has constant co-operation with the shank of the button, and will prevent the loss of the button, even though it should pull loose at one or both ends.

NECKTIE HOLDER.—M. ROSENFIELD, 1339 Burbank St., Alameda, Cal. The invention relates to a necktie holder of the kind that are secured over a collar button, and provided with means to engage a tie and prevent it from shifting to either side or above its intended position. The present invention provides an improved tie engaging means whereby the tie may be more effectively and more readily released than is possible with holders now in use.

Electrical Devices.

ELECTROMAGNETICALLY CONTROLLED KEYBOARD FOR PERFORATING APPARATUS.—B. SOLDATENCOW, 37 Rue La Pérouse, Paris, France. This invention has for its object to provide an electromagnetically controlled keyboard for perforating machines intended for the perforation of the bands of paper utilized for telegraphic apparatus, for example, and it is mainly intended for increasing the rapidity of perforations, while at the same time rendering the machine strong and insuring certainty in operation.

Of Interest to Farmers.

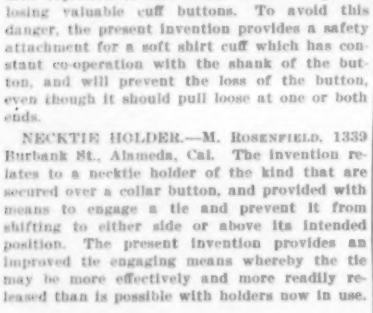
BALING PRESS.—G. F. MADDEN, Roosevelt, Utah. In brief, this hay baling press comprises a housing in which the bale is to be formed, a hopper for guiding the material in front of a plunger, and a belt moved by the plunger in one direction and by a weight in the other, the belt acting to prevent the feeding of material into the housing while the plunger is in a forward position, and serving to retract the plunger by reason of the weight acting thereon. The plunger is actuated by a suitable set of cams which are turned by any desired power.

MACHINE FOR HEADING GRAIN.—C. WOOD, Box 331, Moulton, Iowa. This machine for heading grain is adapted to perform its functions in connection with a harvester and binder. It receives the laterally discharged grain from a harvester and binder with the binding devices removed, and heads the grain thus received, discharging the stalks or straw in one direction and the grain heads in another direction.

DEEP TILLING ATTACHMENT.—E. ROBINSON, Selby, S. D. As an attachment for plows, Mr. Robinson provides a device which takes the place of the front furrow wheel and similarly forms a support for the frame of the plow, also a guide for the plow. Therein it differs from other attachments which are provided with an independent frame detachably secured to the plow, and have adjustable means independent of the means existing on the plow.

Of General Interest.

SECTIONAL TRUNK.—F. DEC. THOMPSON, 18 McDonough St., Brooklyn, N. Y. By constructing a trunk in sections, Mr. Thompson provides an article which may be enlarged or reduced in capacity, according to the needs, at



SECTIONAL TRUNK.

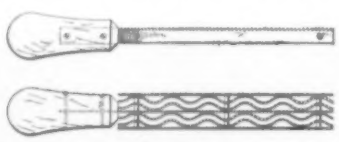
any particular time. The trunk consists of a rectangular bottom section with any number of intermediate sections, each fitted with locking devices for fastening them in place. Any of the sections may be provided with trays.

WALL CONSTRUCTION.—T. J. CAHILL, Suisun, Cal. In order to construct a concrete wall having a degree of elasticity not less than that of brick walls, the present invention contemplates molding the concrete in separate, distinct blocks *in situ* in successive layers, to break joints as in walls built of previously formed blocks. Metallic joint members are provided and form part of the mold, their shape being such as to cause interlocking of adjacent blocks.

APPARATUS FOR MELTING AND PROJECTING FUSIBLE SUBSTANCES.—E. MORF, Zurich, Switzerland. The object of this invention is to provide an apparatus for projecting a fusible substance, as for example a metal wire in a molten state, against a surface for the purpose of providing the same with a fixed or detachable coating. The appliance is either portable or stationary, as most convenient for the work to be performed.

Hardware and Tools.

WOOD RASP.—J. M. DENSMORE, address W. J. Moore, P. O. Box 122, Ashland, Oregon. This rasp is formed of a series of blades of suitable material, which are arranged alongside each other in spaced relation and rigidly connected together, but capable of detachment, thus form-



WOOD RASP.

ing a rasp having openings for permitting the escape of the material cut away. The efficiency of the rasp is increased by providing this clearance and preventing the collection of the material in the rasp to block the cutting mechanism.

SAW.—H. C. NUGENT, 6 W. 104th St., New York city, N. Y. The present invention provides a saw in which the serrated portion or edge may be easily removed from the body or back to which the handle or other operating means may be applied, the toothed edge being so arranged as to be either replaced or to have another blade of a different character substituted therefor.

Heating and Lighting.

GAS LIGHTER.—G. MEYER, 19 Logan St., Auburn, N. Y. Finding that the customary catalytic material used in gas lighters may be kept in good condition if properly housed, Mr. Meyer has invented a gas lighter in which the catalytic member is inclosed until the instant it is to be used. Then it is exposed to the catalytic action for as short a period as possible, after which it is housed again.

Household Appliances.

CLOTHES DRIER.—E. A. WILLIAMS, Canton, Pa. To provide a clothes-drying apparatus suspended from the ceiling of a room; to provide for lowering and elevating the apparatus; to provide for locking the apparatus in raised position, and to provide a means for removing operative parts of the apparatus to avoid interference by persons passing, such are the principal objects of Mr. Williams's invention.

Machines and Mechanical Devices.

ROTARY PUMP.—B. F. CATHCART, 702 K St., Fresno, Cal. This invention relates to improvements in rotary pumps of the vertical type, and has reference more particularly to the casing structure for the pump. An object

ROTARY PUMP.

of the invention is to provide an inexpensive, simple, and efficient rotary pump relieved of end thrusts. The liquid pumped is given a spiral motion by providing spirally directed inlets and outlets.

WOOD MOLDING MACHINE.—L. R. CARROLL, 9 S. Brevard St., Charlotte, North Carolina. This molding machine is provided with a principal bed which may be curved to any desired radius at the will of the operator, and which may be raised or lowered when thus curved. The machine also has an improved arrangement of the chip-breaker, whereby it may be adjusted to accommodate different positions of the adjustable bed.

Musical Instruments.

PNEUMATIC ACTION.—H. H. HOLTKAMP, 1299 Bell Ave., Lakewood, Ohio. An improved pneumatic action is provided by this invention for pipe organs and the like. It is arranged as a conflating device for the union, coupling, confluence, or conjunction of a plurality of ducts controlling the speaking apparatus of sounding or mechanical devices, or of independent ducts or other means, directly or indirectly, for the various functions found in a pneumatic action.

Prime Movers and Their Accessories.

PISTON RING REMOVER.—M. MERLISS, P. O. Box 363, Flint, Mich. This piston ring remover has means for engaging between the split ends of the ring, to spread the ring, so as to permit it to be slipped off the piston without distorting or twisting the ring. The engaging portions of the remover are capable of adjustment with respect to each other, for permitting the remover to be used with any width of ring.

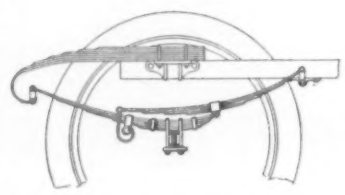
EXPLOSION TURBINE.—T. C. ANDERSEN, Viborg, Province of Jutland, Denmark. This explosion turbine comprises a rotating part and a stationary inner part surrounded by the rotating part and containing piston chambers open at their ends, an axial shaft for said rotating part, pistons for the piston chambers and actuated from the shaft, the rotating part forming the end wall of the piston chambers, and having one exhaust turbine channel for the piston chambers lying in the same horizontal plane, and suitable packing interposed between the rotating part and the chambers.

Railways and Their Accessories.

FREIGHT CAR DOOR.—A. HOILAND, Nome, N. D. The invention provides a door which may be easily opened, even when the car is filled, and which may be swung up in position out of the way, so as to facilitate the loading or unloading of the car. The car door is telescopic, having an extension which may be used when the car is being filled with grain or other light material.

Vehicles and Their Accessories.

SHOCK ABSORBER.—K. SATO, 445 S. Olive St., Los Angeles, Cal. The invention relates more particularly to a spring mounting, equally adapted to the fore and rear ends of a



SHOCK ABSORBER.

frame to be supported and involving a spring arrangement, for the purpose of neutralizing heavy strains and sudden jolts and jars, being therefore in the nature of a shock absorber.

METAL WHEEL.—O. G. SIMMONS, care of Wissler Instrument Works, 611 North Broadway, St. Louis, Mo. The invention relates particularly to wheels for automobiles and comprises a hub, consisting of an inner member designed to be permanently secured to the axle and an outer hub member removable with the spoke and rim bodily from the inner member without disturbing the position or adjustment of the inner member. The hub is made stiffer and stronger and better adapted to the use of metal spokes than similar devices heretofore proposed.

POWER DRIVEN VEHICLE.—J. E. MATSON, Sandusky, Ohio. The object of this invention is to provide a complete power unit having a one-unit frame, and in operative relation a prime mover, transmission mechanism, fuel supply, and controlling devices with means for readily and rapidly installing this unit in operative position, and for removing the same from this position. Another object is to provide a vehicle chassis and a power unit arranged to facilitate the insulation of said unit upon, and its removal from, said chassis, with means for rapidly locking the chassis and power unit in operative relation.

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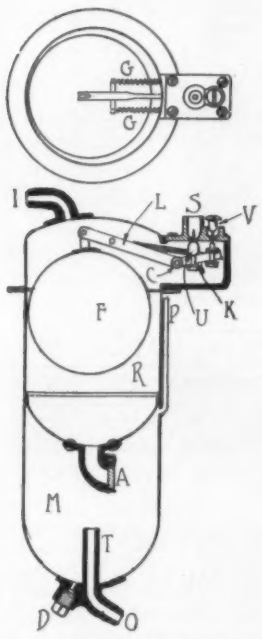
A Vacuum Gasoline Feed System

THERE are three places in which a gasoline tank is customarily located on an automobile; under the front seat, under the dash or cowl of the flush-sided car and under the body at the rear of the frame.

With the advent of deep cushions the under-the-seat type of tank has been almost eliminated for two reasons; when placed so low gasoline will not flow to the carbureter, and because it is limited in capacity. This type of tank has been largely replaced by the rear tank because the latter can be made of large capacity. But the rear tank with the accessories accompanying it has not been popular on low-priced cars because of its expensiveness. An alternative is the dashboard tank, the main advantage of which is gravity feed. Further, with the rear tank and pressure system it is necessary to first pump up enough pressure by hand to raise gasoline to the carbureter. On the road the safety valve of the power pressure pump sometimes sticks, and a high pressure is put on the fuel. This either causes an excessive consumption of gasoline or flooding of the carbureter.

To eliminate these difficulties a vacuum feeding system has been evolved. The auxiliary tank, which contains the mechanism, is located on the dash of the car so that the gasoline flows to the carbureter



Plan and sectional views of the vacuum gasoline feeding device.

by gravity. It eliminates the pressure feed with the rear tank, also two extra pipe lines, a hand and a mechanical air pump and a pressure gage.

This auxiliary gasoline tank is connected to the main gasoline tank at *I*, to the carbureter at *O*, and by means of another pipe to the intake manifold of the motor at *S*. The tank is made in three pieces, a top, an intermediate and a bottom section. The two upper sections form one small reservoir *R*, and the bottom section another, *M*. The two are placed in communication when the valve *A* is opened. In the upper section is placed a float *F*, which regulates the supply of fuel. This float, through the medium of the springs *GG*, and the lever *K*, operates the two valves *V* and *U*.

The action is as follows: The upper reservoir *R* is full of gasoline, the valve *U* is closed, and the valve *V* open. When the valve *V* is open there is atmospheric pressure on the gasoline which will flow into *M* by gravity. As the gasoline is used up the float *F* descends. Note that the float has no positive connection to the other lever *K*, fulcrumed at the same point; only the springs *GG* connect the two levers.

The instant that *L* goes beyond a point at which *L* and *K* are in a straight line, the springs immediately throw *K* to the other extreme of its movement, reversing the valves. By the use of this ingenious combination of levers and springs the opening or closing of the valves is instantaneous. Opening the valve *U* places the upper chamber in communication with the intake manifold. The suction thus created in the chamber *R* closes the valve *A*, and sucks gasoline from the rear tank through the connection *I*. This action continues until the chamber *R* is filled, and the float having risen has reversed the valves. A vent pipe *P* is provided to let air into the lower reservoir when the valve *A* is closed.

At the bottom of the tank is placed a stand pipe *T*, which serves as a water separator and dirt strainer. A drain plug is provided to draw off the water and sediment. The lower chamber is always filled with gasoline, even if the upper one is dry. Hence, there is always enough fuel to start the motor, and once it starts the upper tank fills immediately.

Testing a Safety System for Storing and Distributing Inflammable Liquids

(*Continued from page 40.*)

Though the gasoline burnt with a brilliant and lurid flame, for the few seconds until the automatic shut-off came into action, the contents of the storage tank were perfectly protected.

The demonstration, which took place on the old Guttenburg race track, at North Bergen, N. J., involved the construction of a sample or test installation such as would be used at a small garage with a storage tank of about 350 gallons capacity, and the various appliances for charging and discharging such as would be used in actual practice.

The underlying principle of the system is that the vapor of gasoline or other highly inflammable liquids will not ignite when in proximity to an inert gas, such as carbon dioxide or nitrogen, although a mixture of gasoline vapor and air is highly explosive, as is well known, for, in fact, it is on this property that the use of gasoline vaporized in the internal combustion motor of the automobile depends. In the Martini and Hüneke system carbon dioxide gas is derived from a cylinder of the gas under pressure that is liquefied in the ordinary commercial form, or a mixture of carbon dioxide with nitrogen, which, in the case of large installations, can be specially prepared at the plant, is in contact with the gasoline both in the storage tank and at all points where it is likely to be exposed. Carbon dioxide, when mixed with air in a proportion as low as 30 per cent, supplies a medium in which combustion is impossible. With this gas or mixture of gas taking the place of air in the space above the liquid in the storage tank or in the drum from which it is transferred, it is impossible for the vapor to ignite, as was demonstrated in a striking way by the passage of an electric spark through a spark plug inserted above the liquid in the storage tank. The inert gas used is reduced to a pressure of from 1 to 1½ atmospheres, this being sufficient for a basement or one-story installation.

Previously a demonstration had been made of the explosive effects of gasoline vapor where the space above the liquid was occupied by air. At the demonstration in question the electric spark was passed repeatedly across the gap in the spark plug, and thus it was demonstrated that the contents where protected by the system were perfectly safe from any action of lighting or stray currents. The inert gases under pressure supplying the protection in addition serve to raise the liquid to the draw-off valve through a double lead pipe, the inner pipe carrying the liquid and the outer jacket the gas, which is under the same pressure and in direct communication with the tank. A manometer regulates the pressure at which the gas is maintained constant throughout the system. This inert gas not only is present in the space above the surface of the liquid in the storage tank, but it is contained within the double pipe of the connecting system. These pipes are of lead, and any break in one or the other serves to release the pressure exerted on the liquid, so that the supply is automatic-

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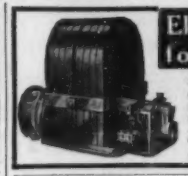

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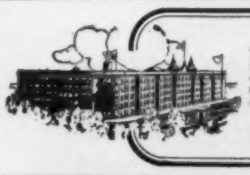

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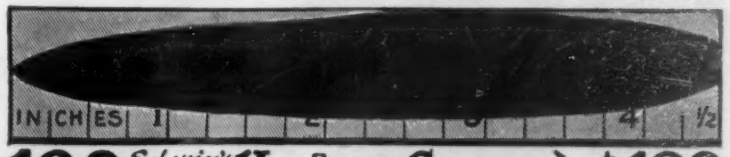

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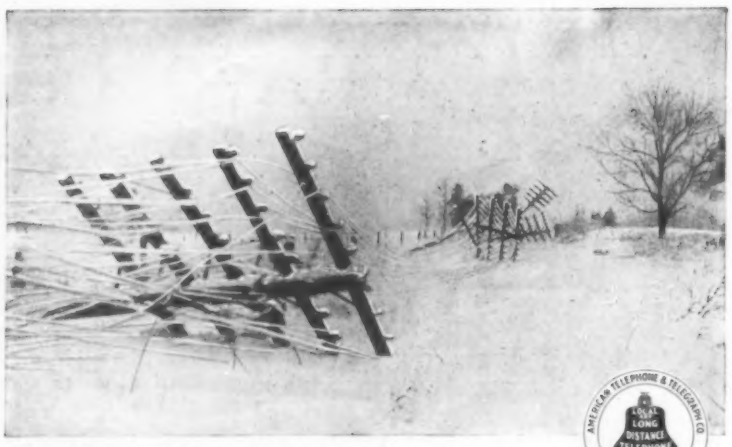

The Telephone Emergency

THE stoutest telephone line cannot stand against such a storm as that which swept the Middle Atlantic coast early in the year. Poles were broken off like wooden toothpicks, and wires were left useless in a tangled skein.

It cost the telephone company over a million dollars to repair that damage, an item to be remembered when we talk about how cheaply telephone service may be given.

More than half of the wire mileage of the Bell System is underground out of the way of storms. The expense of underground conduits and cables is warranted for the important trunk lines with numerous wires and for the lines in the congested districts which serve a large number of people.

But for the suburban and rural lines reaching a scattered population and doing a small business in a large area, it is impracticable to dig trenches, build conduits and lay cables in order that each individual wire may be underground.

More important is the problem of service. Overhead wires are necessary for talking a very long distance. It is impossible to talk more than a limited distance underground, although Bell engineers are making a world's record for underground communication.

Parallel to the underground there must also be overhead wires for the long haul, in order that the Bell System may give service universally between distant parts of the country.

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ally cut off and the air is kept away from the contents of the tank. The only safety valve is the mercury manometer referred to above, and there are no check or other mechanical valves in the system which could deteriorate or fail to act. A liquid seal is used where the gasoline enters and emerges from the storage tank. This liquid seal or so-called "anti-fuser" prevents any air from entering the tank, making it impossible for any explosive mixture to form.

The storage tank of the installation is filled from an ordinary commercial drum, not by gravity, but by the pressure of the inert gas, and the process does not interfere with the discharge, either mechanically or on the score of danger. There is a fusible plug on the gas line both at the entrance valve and at the discharge valve, and in case of fire this plug, which melts at a low temperature, permits the release of gas, driving back the liquid to rest in the storage tank, where it is sealed from the access of air.

At the recent demonstration, in addition to the discharge of the electric spark in the storage tank, an ordinary shipping drum filled with gasoline was connected with the inlet valve of the installation. The gas was permitted access to the interior of the drum, forcing the gasoline into the fill pipe of the system so that there was no chance in the presence of the mixture of carbon dioxide gas and ordinary air for an explosion to occur, notwithstanding the fact that a strong wood fire was built around the drum sufficient to heat the drum to redness and to melt the lead pipe after the drum had been emptied. In other words, the drum became filled with the inert gas, while the gasoline was forced into the storage tank through the supply tube. A somewhat similar demonstration was made with the gasoline passing from the storage tank to the draw-off valve, the latter being open so that the gasoline flowing at full head could be ignited, while wood piled up around the pipes was blazing furiously. Notwithstanding the practical destruction of this part of the installation at the outlet valve, the main mechanism was not put out of operation and the storage tank, with its gasoline, was fully protected, as well as the system of piping. The gasoline stopped flowing after a few seconds had elapsed after the fire was started.

Naturally there are details and modifications in the system as above described in outline, but it has found wide application in Germany and in one installation in the business center of Berlin it is used to protect a storage capacity of 1,000,000 liters (250,000 gallons) of gasoline. For garages and other uses an interesting measuring device can be used, and in dry cleaning a special installation has been arranged which enables all but about three per cent of the naphtha employed in the process to be reclaimed, where formerly some 60 per cent was lost. In this process the water can be removed from the naphtha at various points of the process, and there are other advantages as well as increased safety. The accompanying photographs show the intensity and thoroughness of the recent test.

Rice Bran is a new commodity now being exported from Shanghai to the United States, according to a recent consular report. Until about two years ago, when shipments of it began to be made to Germany, rice bran was used by the Chinese as feed for animals or was neglected as waste; now the 10 mills in Shanghai from which it is obtained cannot supply the demand. It is fed to cattle, and also used as a fertilizer.

Electric Tuning Device for Wireless.—Patent No. 1,096,065 to Earl Glen Stalnaker of Chicago; Charles W. Stalnaker, guardian of minor, assignor to Charles W. Hoff of Chicago, presents a tuning device for a wireless telegraph system in which is provided an apparatus by which the inductance of a circuit or its static capacity, or both, may be varied to make the circuit responsive as more fully described in the patent.

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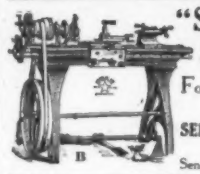

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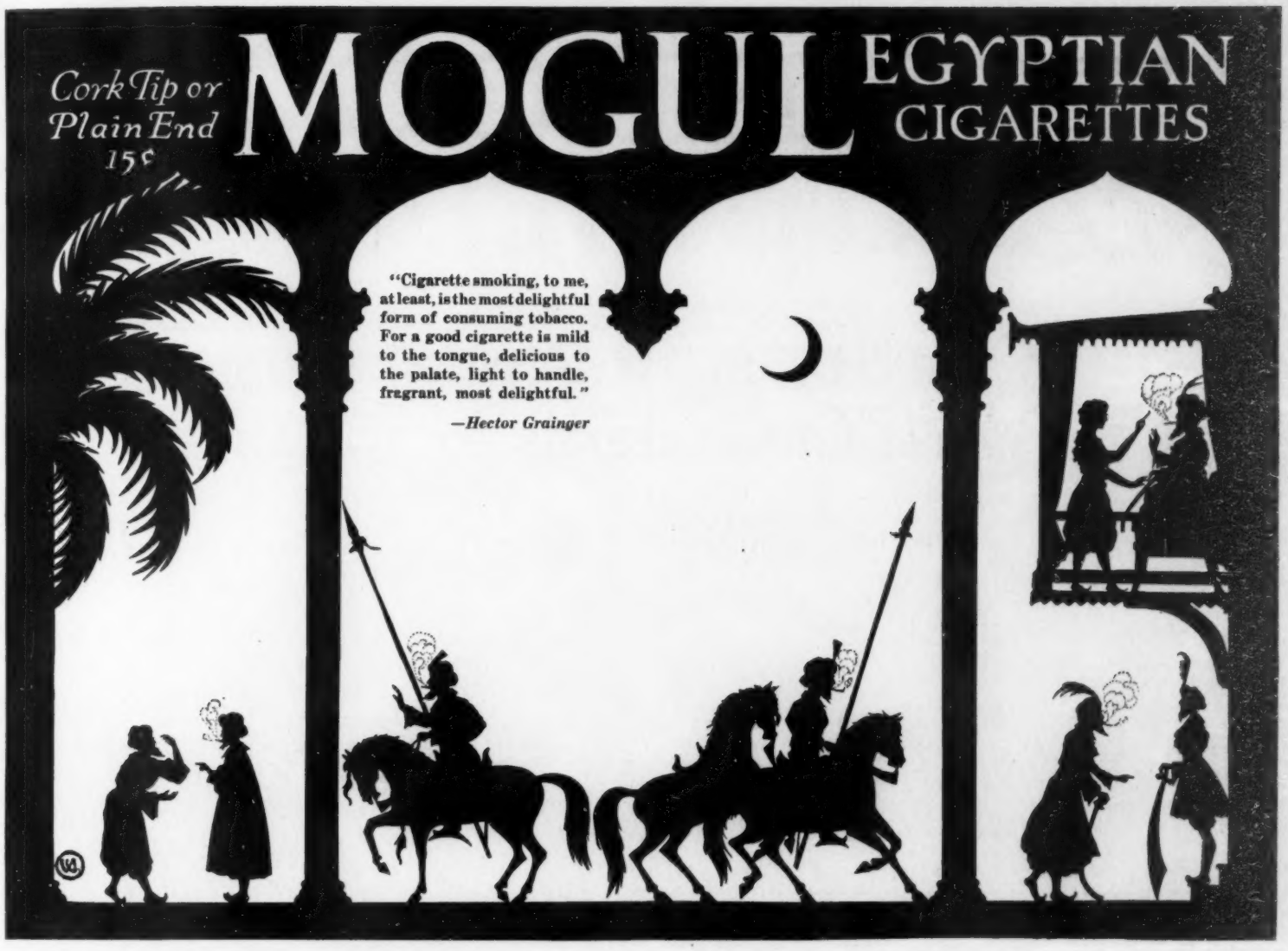
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